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PLANNING THE SECONDARY SCHOOL PLANT. SCHOOL PLANT PLANNING SERIES.

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ONE OF A SERIES OF NINE SCHOOL PLANT PLANNING GUIDES, THIS REPORT OUTLINES SPECIFIC AS WELL AS GENERAL PLANNING PRINCIPLES. A PHILOSOPHICAL BASIS OF PLANNING IS RELATED TO THE EDUCATIONAL NEEDS OF THE SECONDARY SCHOOL STUDENT. PLANNING PROCEDURES INCLUDE LONG RANGE PLANNING AND STEPS FOR OVERALL PLANNING. INCLUDED IN THE STEPS ARE PREPARING EDUCATIONAL SPECIFICATIONS, SELECTING A SITE, DEVELOPING PRELIMINARY AND FINAL PLANS, AND APPROVING FINAL DOCUMENTS. SPACE AND SPACE ORGANIZATION PROBLEMS INVOLVE SIZE, KIND, RELATIONSHIP, FLEXIBILITY, AND SAFETY OF PLANT AND SITE AREAS. SOME SPECIAL PROBLEMS CONSIDERED ARE THERMAL, VISUAL, AND AUDITORY ENVIRONMENTS, PLUMBING FACILITIES, MAINTENANCE, AND DECORATION. KINDS OF SPACES AND THE SPECIAL REQUIREMENTS OF EACH KIND RECEIVE MUCH INDIVIDUAL ATTENTION IN THE FINAL CHAPTER. A BIBLIOGRAPHY OF RELATED MATERIALS IS INCLUDED AT THE END OF THE REPORT. (RH)

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UTAH STATE BOARD OF EDUCATION

Research Report

PLANNING THE SECONDARY SCHOOL PLANT

School Plant Planning Series

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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SCHOOL PLANT PLANNING SERIES

PLANNING THE SECONDARY SCHOOL PLANT

T. H. Bell, State Superintendent
UTAH STATE BOARD OF EDUCATION
223 State Capitol
Salt Lake City, Utah

DIVISION OF RESEARCH AND PLANNING
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Chapter I - THE BASIS OF GOOD PLANNING

The Starting Point of Good Planning

The secondary school plant--site, buildings, furniture and equipment--is an instrument of education. As such it is more than a tool, merely. It is the setting, the environment in which adolescents grow and develop and learn. The effectiveness and efficiency of the school plant depends upon how well it is planned, designed and constructed.

The chief reference points for good planning lie in the nature and needs of adolescents and in the educational program to be provided for them. Good architecture follows good educational planning. The physical facilities making up the school plant are an essential and critical part of the total educational program--as much a part of the educational program as the activities to be carried on through their use. In the words of Winston Churchill, "We shape our buildings and our buildings shape us."

The formulation and expression of the educational program as a basis for architecture is a tremendous responsibility. Good procedures for carrying out this responsibility, based upon well-tried experience, have been outlined in a publication of the Utah State Board of Education, Planning a School Plant--The Educational Specifications.

The nature and needs of secondary school students have become well and widely known and, except for varying emphasis and application to meet the changing conditions of an evolving social order, tend to remain constant. Similarly the aims and purposes of the program of the secondary school, at least in the abstract, have been given definition which tends to be lasting; but the organized educational program is something else. Far from being constant or enduring, the educational program of the

secondary school is undergoing significant change--a change which will doubtless be more profound as we move into the industrial revolution brought about by the technological application of atomic energy and electronics.

The hardest problem facing educational planners and architects is the problem of designing facilities in which obsolescence due to unsuitability will be held to a minimum as the educational program evolves. Some suggestions regarding meeting this problem are made in Chapter 4; but at this point a further word about obsolescence is appropriate. It has been said that the most common factors of obsolescence lie in the two areas: school sites and aesthetics. With respect to site the factors of obsolescence have to do either with location or with adequacy (see Chapter 3). With respect to aesthetics it should be remembered that the buildings which are kept are the buildings which are loved. In no area of design should architects be given greater freedom than in the area of aesthetics. To increase the comfort and delight of students in the educational environment has profound and real utilitarian value.

The Needs of Secondary School Students

1. Adolescents Are Concerned About Their Relationships With Other People. The school should provide students with wide and varied experiences to help them see how and why others act as they do, and to allow them to gauge themselves in comparison with others in wholesome relationships. Common media for such experiences lie in student assembly programs, exchange programs, public gatherings, democratically organized school community, emphasis upon student participation in school parties, games, sports, and student government.

Implications for Facilities: Ample auditorium, gymnasium, athletic and recreation facilities; good grooming centers for girls and for boys; design of corridors, courts, student commons, snack bar, etc. for relaxed and pleasant peer relationships (both unstructured and structured).

2. Adolescents Are Curious About Themselves and Their Environment. The school should provide the activities and facilities to encourage and allow students to become aware of and to develop their own interests and abilities. Exploration activities in many areas of work and living supplemented by testing and counseling provide the chief media for the necessary experiences.

   Implications for Facilities: Carefully planned facilities for well-rounded programs in industrial arts, homemaking, science, art, music, speech and communications, and ample display facilities (bulletin boards, cases, and cabinets) within instructional spaces and in public areas of the school. Well planned instructional materials centers or libraries are essential.

3. Adolescents Must Adjust to Rapid and Profound Body Changes. The school must help students to understand adolescent body changes and to maintain wholesome attitudes of self-regard. At this age personal appearance takes on increased and new importance. Students respond favorably to opportunities to discuss privately their questions and concern about themselves. New drives and nervous tensions can be relaxed and find outlet through many kinds of physical activities and through carefully structured social activities.

   Implications for Facilities: Classrooms of sufficient size to allow project teaching and for movement in small groups and individual

research and exploration; facilities for an adequate counseling program, and space, especially in the physical education units, for private conference between teachers and students; well ordered physical and health education facilities.

4. Adolescents Have a Drive Toward Independence and at the Same Time Must Have Feelings of Security. In striving toward grown-up behavior unpredictable reversions to childish patterns are common. There is a characteristic urge to explore and tryout new experiences. The school therefore should provide increasing independence in learning experiences and the assumption of responsibility by the student for evaluating those experiences--not alone within the courses of study, but in student body affairs and in their personal lives.

   Implications for Facilities: Well planned instructional spaces to house a rich, full educational program--shop courses, arts, crafts, vocal and instrumental music, business, homemaking, dramatics, public speaking, debating, foreign language, and all of the traditional subjects; spaces for student community activities--student government, student publications, etc.

5. Adolescents Strive for Personal Values and Social Status. Peer relationships are critical. Social acceptance and feelings of belonging are of prime importance. The school should provide an environment or climate in which a premium is placed upon personal values and the services to implement a sound guidance program.

   Implications for Facilities: Facilities should be designed for well ordered housekeeping. The school plant must be aesthetically pleasing, homelike and relaxing rather than institutional. The spaces in which unstructured peer relationships most commonly occur--

corridors, courts, student commons, etc.--should be designed to avoid crowding and confusion, but rather to invite and encourage students to express their own personal values in association with each other.

6. Adolescents Want to Participate as Responsible Members of a Larger Group. In addition to responsibility as a member of the school community, the school should provide many opportunities for students to belong to teams, clubs, committees, and various organized groups characterized by a group spirit.

   Implications for Facilities: Facilities for student government, service groups, social committees, band, orchestra, choral groups, dramatics, debating, athletic teams, etc.; facilities for use of such media as radio, television, recordings, intercommunication system.

7. Adolescents Desire Many Outlets for Expressing Their Ideas and Feelings. The activities of instructional rooms, if democratic and organized around the project-problem method, provide the greatest opportunity for expression of student ideas and feelings. In addition to suitable instructional spaces the school should provide opportunity for student expression through assembly programs, intercommunication media, school publications, student government, cooperation with agencies in the larger community.

   Implications for Facilities: Classrooms of sufficient size to allow the use of group dynamics and with facilities for use of a wide range of instructional aids; well organized and fully stocked library to provide research sources for the gathering of ideas; facilities for student performances, student government, student publications.

8. Adolescents Want Sufficient Knowledge and Skill to Permit Them to Proceed on Their Own. The school should provide the experiences

which will help each student in the optimum acquisition of the knowledges, understandings, and skills basic to responsible and competent living--including the basic skills for further learning and communication, knowledge and understanding of the physical and social-civic environments. Learning experiences should be individualized in terms of student interests, abilities, and work rates. Education is increasingly becoming a clinical function. Teachers need the staff help of persons competent in the areas of counseling and psychological and health services.

Implications for Facilities: Instructional spaces and related facilities which allow for individualized instruction; ample library facilities with conference rooms, facilities for psychological and health staff services.

The Secondary School Educational Program

Eight basic educational objectives have been formulated by the State Course of Study Commission as a foundation for curriculum development in all subject areas. The interdependence of facilities and educational program necessitates an awareness of these objectives on the part of those engaged in planning the facilities.

1. Developing an appreciation for and performing the responsibilities of American citizenship.
2. Developing attitudes and competencies which facilitate learning.
3. Achieving and maintaining physical and mental health.
4. Developing vocational competence and assuming economic responsibilities.
5. Understanding the environment and conserving resources.
6. Improving human relations and family living.

7. Achieving moral and spiritual values.

8. Satisfying aesthetic needs and enjoying wholesome leisure.

How the educational program may be organized to achieve these universal aims and purposes will certainly be influenced by many factors peculiar to each locality. However, the preferred pattern of organization, where enrollment permits, is to separate the junior high school program and the senior high school program into different school plants. The concept of economical size of schools is delt with in Chapter 3.

At this point certain other related concepts should be noted. Among the trends in secondary education perhaps none is more significant than the growing recognition of the importance of knowing each student as an individual, not just as another name on the roll; and the parallel emphasis upon personality, emotional, and social factors in the individual student's development.

These related concepts have profound implications for the planning of the school plant--as to methods of instruction and increased use of a wide range of instructional materials and as to the provision of a variety of spaces for social experiences (courts, corridors, student commons, student government facilities, spaces for party activities, etc.). Facilities for guidance activities, including counseling, become increasingly important under the new emphasis upon the student as an individual.

Consideration of factors of economy demands that the number and kinds of spaces be provided in the school plant so that a maximum utilization of space may result consistent with effective operation of the educational program. In smaller schools, especially, it is necessary to plan for the use of certain spaces for more than one part of the program in order to avoid having an excess amount of idle space during the school day. When

this is done, it is desirable to provide an amount of space sufficient to accommodate the greatest need and to add to this the auxiliary facilities, including storage for the other activities as well.

The minimum of space which must be provided must at least accommodate the anticipated enrollment in the required program of studies as adopted by the State Board of Education. Following is an outline of the requirements.

1. Junior High School Program of Studies

Definition of a Unit as Referred to Below for the Junior High School

A unit represents a year's study on a daily basis in any junior high school subject. These requirements apply to students in grades 7-9, in all junior high schools and in all six-year high schools or variations thereof, but do not apply to students in grades seven and eight in elementary schools.

Subjects to be Required of Every Student - Grades Seven Through Nine

a. Language Arts — Required Units 3

Grade Requirement	7	8	9
	Language Arts 1 unit	Language Arts 1 unit	Language Arts 1 unit

Remedial programs in language arts may be substituted for basic language arts courses at any grade level. On an individual guidance basis a foreign language may be substituted for ninth grade language arts, with the understanding that a foreign language may not then be substituted for a unit of English in the senior high school.

b. Social Studies — Required Units 2

Grade Requirement	7	8	9
	Utah History ½ unit	U.S. History & Citizenship 1 unit	World Geography ½ unit

Two units of social studies are required as indicated above and three units are recommended. Each district is to determine the method of expanding the social studies offering at seventh and ninth grade to one full unit each, as desired.

(Explanation: The Utah History course should place major emphasis upon community problems, political and industrial development of Utah, Utah's physical and economic geography and Utah's role in the continued growth of the West.)

c. Mathematics — Required Units 2

Grade Requirement	7	8
	Arithmetic 1 unit	Arithmetic 1 unit

Algebra at the ninth grade level is required to be offered to students on an elective basis. It is recommended that this course be designed primarily for those student who intend to complete college entrance requirements leading to a major in such subjects as mathematics, the physical sciences, or engineering.

d. Science — Required Units 1

One unit of general science is required in either the eighth or ninth grade. It is recommended that local districts require an additional unit of science.

e. Health — Required Units . . . . . ½

One-half unit of health is required in either the seventh or eighth grades. Credit is to be given independently of any other subject.

f. Physical Education — Required Units 1½

One and one-half units of physical education are required. This work shall be taken over a period of three years (seventh, eighth and ninth grades with one-half unit as a minimum for each year). Credit for physical education shall be given independently of any other subject.

g. Homemaking — Required Units 1

One unit of homemaking is required of all junior high school girls. It is recommended that one semester be required in the seventh grade and one semester be required in the eighth grade. However, where it is not possible to offer any homemaking in the seventh grade, one full year of preliminary homemaking in the eighth or the ninth grade will meet this requirement. It is recommended that a full year elective program be offered in the ninth grade.

h. Industrial Arts — Required Units 1

One unit of industrial arts is required of all junior high school boys. It is recommended that one semester be required in the seventh grade and one semester be required in the eighth grade. However, where it is not possible to offer any industrial arts in the seventh grade, one full year of industrial arts in the eighth or ninth grade will meet this requirement if the recommended state program is followed. It is recommended that a full year elective program be offered in the ninth grade.

i. Art — Required Units . . . . . ½

This one-half unit of art may be taken in any grade, seven through nine.

j. Music — Required Units . . . . . ½

One-half unit of music is required in any grade, seven through nine. General music is recommended.

2. Senior High School Program of Studies

Definition of a Unit as Referred to Below for the Senior High School

A unit of credit shall be given upon satisfactory completion of a course the duration of which shall be at least fifty minutes multiplied by the number of days prescribed by the State Board of Education for the school year.

a. Language Arts — Required Units 3

At least two units must be in English. There may be substituted for either eleventh or twelfth grade English one unit or its equivalent from among the subjects offered in grades 10-12 in the general area of the language arts (e.g. speech, foreign language, remedial English or reading, journalism, debate, etc.). The substitution of foreign language for a unit of English in the senior high school shall not be permitted if a sutdent has substituted a unit of foreign language for language arts in the ninth grade.

b. Social Studies — Required Units 2

One unit must be in American History and Government. The other unit required may be from one or a combination of the following: World History - one unit; America's Social and Economic Problems - one unit; Sociology - one-half unit; World Geography - one-half unit; or Economics - one half unit.

c. Mathematics — Required Units 1

Algebra taken in the ninth grade will not meet this requirement for any student entering the ninth grade beginning with the school year of 1958-59.

d. Science — Required Units 1

This may be either physical or biological science. It must be either biology, botany, zoology, physiology, agricultural science, physics, chemistry, senior physical science, or a combination of any two of the biological science courses listed above which are offered on a one-half unit basis.

e. Health Required Units . . . . . ½

Physiology may not be substituted for the health requirement. It is recommended when possible that health be taught as a semester course daily for one semester. When health is taught in alternation with some other subject, such as physical education, the number of class periods shall be equivalent to a one semester course. Credit for health shall be given independently of any other subject.

f. Physical Education Required Units 1

One unit of physical education is required. This work shall be taken on a half-unit basis in any two of the three grades, ten through twelve. However, participation in a program of intramural sports (approved by the State Board of Education) may be accepted for one-half unit of the requirement. A high school offering an R.O.T.C. program may substitute R.O.T.C. for one-half unit of physical education. In exceptional cases, upon application by the school district and approval by the State Board of Education, R.O.T.C. may be substituted for the second one-half unit of physical education.

Subjects Which High School are Required to Teach

A. All subjects required for graduation. Some of these subjects required for graduation may be offered on an alternate year's basis.

B. Each high school must offer the following subjects to students who desire to take them. Some of these subjects, at the discretion of the school, may be offered on an alternate year basis, provided the subjects are available during the normal high school residence of any one student.

1. Algebra
2. Geometry
3. Second year Algebra (full year)
4. Consumer Mathematics
5. Biology
6. Physics, Chemistry, or senior Physical Science
7. World History
8. America's Social and Economic Problems
9. Typing, first and second year
10. A foreign language, provided the school has an enrollment of at least 350 students in grades 10-12
11. Fine arts (music and art must be offered in every high school)
12. Homemaking, at least two units, one of which must be in Home Living
13. Industrial Arts, at least two units. Courses in farm mechanics or in trades and industries may be used to meet this requirement.

Time Schedule - Junior and senior high schools must be offering these subjects no later than the school year 1958-59. The senior high school requirements shall be effective for graduates of the school year 1960-61.

Exception - Any high school which, because of small enrollment, desires to be exempted from offering any one or more of the above required classes may be exempted only on specific application to the State Board of Education and approval of the State Board. Exemption will probably be permitted only when arrangements have been made for the school district to enroll the students in a home study extension course which may be desired by the student, the registration free to be paid by the school district.

General Exception - Any junior or senior high school, on a personal guidance basis, may exempt any student from meeting any one unit or its equivalent of these requirements, provided the number of students so exempted does not exceed five per cent of the class enrollment, and any student may be exempted from meeting two units of the requirements, provided the number of students so exempted does not exceed two per cent of the class enrollment.

Regulation Affecting Driver Training - Driver training class instuction time cannot be taken from a required one semester or equivalent course. It is strongly recommended that behind-the-wheel driver education time necessary during the school day be distributed among several classes.

3. High School Graduation Requirements

A minimum of fifteen contact units of credit earned in the tenth, eleventh, and twelfth grades and in a six-period day are required for graduation from high school. Required in the fifteen units are the following:

Units as Defined in Program of Studies

3 Language Arts
2 Social Studies
1 Mathematics
1 Science
1 Physical Education
½ Health

Elective Units

6½

In addition to the above requirements, the following provisions are also in effect:

a. The student shall have been in attendance six semesters. (Note: Local boards of education may make exceptions to the six semester requirement upon the recommendation of the superintendent.)

b. While graduation requirements are based upon the last three years of the secondary program, grades ten to twelve inclusive

at least for the present records for college entrance must be made on the basis of grades nine through twelve.

c. The credit requirement for graduation is to become effective for students entering the tenth grade in September of 1958.

d. While the contact unit as defined above has been adopted by the State Board of Education, said adoption was made with the added provision that districts now using other than the contact unit may continue to do so within the district but that any transfer of credit outside of the district must be made on the basis of the state adopted contact unit.

A School Plant Should Be Planned as a Part of a Long-Range Program

The greatest assurance of long-time, district-wide economy can be had only when each school plant is conceived as a step in carrying out a previously planned long-range program of school plant needs. The procedures in formulating a district-wide long-range program of school plant needs are well known.[1] Briefly, the major steps include the following:

1. Forecasting the school population. A short-range (five Years) estimate of school enrollments can ordinarily be made with some confidence; but costly mistakes (overbuilding or underbuilding) may be made unless the long-range probability of increases and decreases and the extent of these possible changes are carefully weighed. All of the factors which might cause changes in school population should be studied.

2. Appraising existing school plants. Existing school plants should be evaluated in terms of:

   a. Structural safety
   b. Satisfactoriness as to factors of health and comfort
   c. Satisfactoriness as to educational utility
   d. Feasibility of remodeling, rehabilitation, and modernization
   e. Relationship to desirable organization of attendance areas

3. Formulating the master long-range program. On the basis of the predicted school population and the appraisal of existing facilities, specific needs may be itemized and listed and assigned priorities. The

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[1]See the references listed at the end of this publication, particularly the publication of the Utah State Board of Education, Planning a Program of School Plant Construction.

natural uncertainty of remote needs obviates priorities, but nonetheless such needs should be listed.

Some of the recognized advantages to be had from the formulation of a long-range program of school plant needs (and we should add that this is not a single event in time, but a continuous process) should be mentioned here.

1. Eventual realization of the most economical organization of school centers and attendance areas (including desirable age-grade organization of schools).
2. An approach to equal educational opportunities for all school children in the district.
3. Districtwide support for the building program and the financing program.

The Overall Steps in Planning a School Plant

The procedures essential to good planning may be considered as coming within several major steps.[2]

1. Setting up the planning organization and outlining the procedures to be followed.
2. Formulating the educational specifications.
3. Selecting the architect.
4. Selecting the site.
5. Developing preliminary plans.
6. Working with the Utah State Board of Education.
7. Approving final plans and specifications.

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[2]See the references at the end of this publication, particularly the publication of the Utah State Board of Education, Planning a School Plant--The Educational Specifications.

1. The Planning Organization and Procedures.

a. For the planning of a school plant, vigorous, competent leadership is the key to success of the planning team. While there is no single good organizational pattern, yet experience has shown that the educational planning group is best:

(1) When there is wide participation--members of the superintendent's staff at the district level, principal, teachers, representative citizens.

(2) When the citizens have been selected so that influential agencies are officially represented.

(3) When the members are chosen so that they will be working members, not mere window dressing only.

(4) When the activities of the planning committee are scheduled so that it is a research and problem solving group, not merely a rubber stamp approval group.

(5) When sufficient time is allowed for the work of the planning group--at least one year for a complete school plant.

(6) When the architect has been selected in time to be available to the committee for consultation during the preparation of the educational specifications.

(7) When a timely use is made of competent educational consultants, including the staff of the State Board of Education.

Suggested Organizational Pattern
The Planning Team

District Board of Education
Superintendent or Staff
Building Specialist

Architect — Executive Committee — Educational Consultants
Division of School Plant
Planning, State School Office

Large Committee

Sub Committees--One for each
specialized area of the school plant

b. The planning procedures should follow in logical sequence.

(1) A study of the community--the cultural and economic setting for the school.

(2) A study of school population.

(3) A definition of the educational program.

(4) A study of the kinds, amounts, and organization of space and facilities needed.

(5) The formulation of the educational specifications.

2. Formulating the Educational Specifications

The format of the educational specifications may vary, but the content should be comprehensive and presented in language easily understood by the architect. The following outline of content is taken by permission from School Plant Studies BT-1-24, American Architectural Foundation--American Institute of Architects, January-February, 1955.[3]

Recommended Content for Educational Specifications

General Considerations

BRIEF DESCRIPTION OF EDUCATIONAL PLAN

Program Considerations
- General statement of philosophy
- General characteristics of the community
- General characteristics of the student body
- General characteristics of the curriculum
- General relationships of this school to the school system

Administrative Considerations
- Description of attendance area
- Description of grades and groups to be accommodated
- Anticipated enrollments by (1) grades, (2) years, and (3) courses
- Personnel requirements

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[3]This issue of School Plant Studies is one of two issues devoted to the same subject. Their content is derived from articles by Russel E. Wilson which appeared in The Nation's Schools, Vol. 56, No. 4 and 6, 1956.

BRIEF DESCRIPTION OF PHYSICAL PLAN

General character of the building
- Architectural style
- General type of construction
- General Atmosphere to be created by the building
- Major sections or units of the building
- Preferred number of stories

General facilities required in the building: instructional, non-instructional, and community-use areas

General characteristics of the site: location, size and dimensions, physical description (topography, soil, etc.), and available public utilities

Detailed Statements of Desired Spaces and Educational Program

INSTRUCTIONAL SPACES

Required numbers and kinds of rooms
Descriptions of the program, functions and facilities for each room
- Sizes and kinds of groups to be accommodated
- Types of activities to be provided for
- Location and relationship to other facilities
- Physical arrangements and features
- Descriptions and lists of the equipment, furniture and materials
- Teaching methods

NON-INSTRUCTIONAL SPACES

Required numbers and kinds of rooms
Descriptions of the functions and facilities for each room
- Sizes and kinds of groups to be accommodated
- Types of activities to be provided for
- Location and relationship to other facilities
- Physical arrangements and features
- Descriptions and lists of the equipment, furniture and materials

Detailed Statements of Desired Site Arrangements and Development

INSTRUCTION AND RECREATION FACILITIES: outdoor class areas, free play areas, organized game areas, and equipment requirements.

ARRANGEMENTS FOR SERVICE FACILITIES AND BEAUTIFICATIONS: Landscaping requirements, service drives, parking requirements, sidewalks and approaches, and pupil transportation requirements

Detailed Statements Regarding Physical Details of Building

STRUCTURAL DETAILS: Lighting, acoustical, hardware and lock system, floor, and wall surface

MECHANICAL SYSTEMS: ventilation, plumbing and heating

UTILITY SERVICES: electrical power systems, fire alarm systems, gas service, sewage systems, communication systems, clock and program systems, and water supply

3. Selecting the Architect

Because of the critically important role of the architect as a member of the planning team, great care should be used in his selection. A recommended standard questionnaire to be filled out by the prospective architect has been published by the National Council on Schoolhouse Construction (jointly copyrighted by that organization and the American Institute of Architects).

The content indicates the major factors which should be considered by the Board of Education. The screening procedures should be deliberate and carried out with due regard for the dignity and professional integrity of the applicants.

A word of caution is in order in case the screening includes visits by the board to buildings cited by applicants. It is hard for trained people to make evaluations of buildings which will be in agreement. It is harder still for boards of education to make valid judgments of buildings. Such visits, then, should not be allowed to overshadow other considerations.

The quality of architectural service like the quality of building materials tends to be determined by what you are willing to pay for it. For this reason selection of an architect on the basis of fee competition is a handicap rather than an advantage. Whatever the fee, it is still a very small amount when compared to the lifetime cost of the facilities which the architect, more than anyone else, is in the best position to control. The best

architectural service is the most economical regardless of its cost.

4. Selecting the Site.

For various reasons it is desirable for school sites to have been selected well in advance of the time for the planning of buildings. Criteria for site selection and use are presented in Chapter III; but in cases where a new site must be selected at the time the buildings are to be planned, the services of the architect will be valuable. In any event, evaluation and study of the site for its best possible use is an important part of formulating the educational specifications.

5. Developing Preliminary Plans.

The educational specifications become the basis for the architectural program. The educational specifications which mark the culmination of the educator members of the planning team's chief contribution to planning have to be translated by the architect into his own program within which he makes his own unique contribution to planning. Frequently the educational specifications will contain rough, free hand sketches showing preferred space relationships.

The first step taken by the architect is to make single line schematic drawings. Often there will be many different schematics to be reviewed by the educator members of the planning team.

The next step of the architect is the development of preliminary plans. It is during this state that decisions are made regarding kinds, amounts, and organization of space; and about structural design and finish materials; as well as the design of the visual, thermal, and auditory environment. Frequent conferences are necessary between the architect and responsible school personnel. It is during the development of preliminary plans when consultation with the staff of the Utah State Board

of Education (arranged through the Division of School Plant Planning) is most helpful.

The preliminary plans should include all of the architectural drawings of the final plans, including floor plans, elevations, and interior sections. Detail of cabinet and case work should be shown as should floor, wall, and ceiling finishes. The elements of the design for the control of the visual, thermal, and auditory environments should be established before the preparation of final plans and specifications is undertaken.

In the interest of securing the best possible and most economical plans, two policies are of critical importance. First, the architect must be allowed sufficient time for research and study of design problems--desirably not less than one year for a school plant of substantial size; and second, the architect should be given the greatest possible freedom for the exercise of creative talent and the coordination of the many design factors.

The architect should be requested to submit to the board early schematic drawings of his proposal and as these are refined cooperatively between the school board and the architect it is desirable to have a model made up to demonstrate the finished building.

6. Approving Final Plans and Specifications.

The final plans and specifications provide the final check on all of the preceding planning. Because of this, every detail should be reviewed to make sure that nothing has been overlooked and to be sure that all elements have been coordinated. Change orders after construction have started are sometimes necessary, but it is better to have the plans so complete that change orders are held to a minimum. Moreover, boards

of education and responsible school personnel should be so familiar with the plans and specifications that there will be no surprises and no disappointments when the buildings are ready for occupancy.

7. Working With the State Board of Education.

The laws of the State of Utah require that before school construction costing in excess of $20,000 in the school districts may be undertaken, the signed approval of the State Superintendent of Public Instruction must be secured on the final plans and specifications (which must have been prepared by a licensed architect). The law also authorizes the State Superintendent to prepare a code to govern the preparation of plans and specifications for such construction.

The Utah State Board of Education has prepared a series of publications to serve as guides to school plant planning, thus discharging the "code" obligation of the law. It is the established policy of the State Board of Education to provide leadership through consulting service rather than to exercise regulatory authority.

Through the Division of School Plant Planning, this service is made available to school personnel and to architects and engineers upon request. The Administrator of the Division acts as an agent of the State Superintendent of Public Instruction. He receives and reviews plans and secures the services of the various staff members of the Department to review the plans for facilities in their respective areas of the curriculum. It is most common for a district superintendent or his staff building specialist together with the architect to come to the State Office for conferences on plans. Very often the architect is authorized by the local board of education to work at his convenience with the State Office.

Obviously, consultation service is most helpful during the development of preliminary plans. Use of the service by school districts is voluntary. Legally it is necessary only to present final plans and specifications for review and approval; but it is equally obvious that final approval will be both more meaningful and expeditious after preliminary plans have been in for review and consultation.

Chapter III - PROBLEMS OF SPACE AND SPACE ORGANIZATION

Size of School

The optimum size for a secondary school is not easily determined. Many factors must be considered. The same factors inevitably take on different weight at different times and in different locations. Population distribution, availability of acceptable sites, and the existence of present school plants too costly to abandon sometimes are more decisive than the factors having to do with the educational program.

On the one hand the school should be small enough so that it is easy to know each student as an individual; and small enough so that the sociological-psychological climate induces in the individual student a feeling of belonging and makes it easier for him to identify himself with organized activities. On the other hand the school should be large enough to allow low unit cost in providing a full, rich curriculum. It has been suggested that the optimum size for junior high schools ranges from 500 to 700 students, and for senior high schools from 700 to 1,250 students.

The problem of size takes on dollar meaning with respect to certain general and special-use facilities, and calculation of construction costs of these units may be decisive in determining not only the size of schools but the type--that is, whether the school should be a combination junior-senior high school or two separate schools. The approach to solutions is through the simple arithmetic of translating the educational program into a time schedule of use.

Can a single gymnasium house the required number of periods per day or should there be two gymnasiums to house the desired program? Or can

it be made to do so by installation of a motorized partition with satisfactory sound drop? Or can such a unit also serve as auditorium through a combination use? The gymnasium and auditorium are perhaps the best examples of problems in which the arithmetic of use schedules can be used as an approach to decisions as to size of school, but other special-use and general-use spaces may be treated similarly. The point at issue is, of course, whether the added cost of duplicating or enlarging needed facilities to house a larger school might justify the addition of a separate school plant in order to secure the educational advantages of smaller schools.

Spaces Needed to House the Educational Program

The design of space has three facets--amount or square footage of area, organization or arrangement, and the provision of related facilities (storage space and casework and instructional equipment). The number of the different kinds of space needed is, of course, determined by the numbers of students participating in the various elements of the curriculum. Economy demands a high level of utilization of space, and hence it is often necessary to plan for the multiple use of certain spaces. In this connection the principle of flexibility, treated below, finds application,

The kinds of spaces needed to house the secondary school program, for convenience, may be listed under five categories: Administrative, General Use, Instructional, Auxiliary and Service, Connecting.

1. Administrative

   Clerical office
   Waiting space
   Vault and record storage
   Supply storage
   Book storage
   Office for principal and assistants

Health suite, including isolation space and facilities for the temporary care of sick or injured students
Student activity facilities--for student government and student publication
Teachers' room
Toilet rooms for office personnel and teachers
Counseling facilities (adjacent to, but independent of the administration suite)

2. General Use

Auditorium
Library
Food service
Gymnasium

3. Instructional (see courses listed in Chapter I, above)
Science
Language arts
Social studies
Mathematics
Health
Physical education
Foreign language
Music
Homemaking
Industrial arts
Business
Art
Other vocational subjects

4. Auxiliary Service

Heating plant and mechanical, electrical and water service systems
General toilets
Custodial storage and work spaces
Receiving facilities

5. Connecting Spaces

Foyers, corridors, courts, commons

Space Relationships

The overall space of the school plant should be organized to place the facilities close together for some parts of the educational program and to isolate or separate other parts of the program. The cues for these

relationships are to be found in the nature of the respective activities--the affinity of certain activities, the problems of circulation and access, the control of sound; all should be considered.

Examples of affinity.

1. Library close to social studies and language arts classrooms.
2. Industrial Arts and Crafts units reasonably near to auditorium stage.
3. Music rooms adjacent to auditorium stage.

Examples of Isolation and Separation

1. Noisy activities away from quiet activities; e.g. shops, food service, gymnasium, typing and business machines, and music facilities away from other classrooms.

Examples of Circulation and Access

1. Gang toilet rooms
2. Facilities requiring service access for vehicular traffic.
3. Facilities to be used by the public.

Flexibility Through Space Organization

The utility of a given space may be increased by so organizing it and providing related facilities which will allow multiple use or allow conversion to a different use without structural changes. This principle of flexibility should be given careful consideration in the design of secondary school buildings.

The starting point in taking advantage of the principle of flexibility is to provide large enough net area to allow multiple use and to permit conversion to a different use. The next point to consider is the

provision of storage space which will meet the needs of all of the multiple uses as well as the needs of any use to which the space may be converted. Closely related to storage facilities is the question of casework, which in order to yield maximum flexibility should be modular and movable. Other items to be considered include the provision of chalk board, tackboard, devices for hanging instructional equipment such as maps, charts, etc. The design of service systems (electrical, water) sufficient to meet the needs of all possible uses is also critical.

Safety Through Space Organization

Safety for the occupants of school buildings is critically determined by the organization of space with respect to circulation or traffic. The length and width of corridors and arrangement of access to the various spaces should be designed in terms of a careful study of peak traffic loads and time schedules of movement. The necessity for crowding should be avoided. Desirably the few minutes during which the students are moving from one part of a building to another between classes should be pleasurable and relaxing; but corridors and exits must be designed not only for normal circulation, but to reduce panic when the need arises for the sudden and rapid emptying of the building. More is said about safety through structural design in Chapter IV.

The School Site and Site Organization

A Good Choice Should Be Made.

The school site provides much more than a location for a school building. It is more than the exterior setting and environment of the school program. The site is itself an important part of the facilities

(space) needed for educational activities. Much care is required in the selection of the site. The suggestion is offered that immediate costs in site acquisition should not give rise to decisions to acquire sites which will prove less than adequate. The cost of sites quite properly may be prorated over the life expectancy of the buildings. When so viewed, the initial cost of a site may not seem so large. Moreover, it should be remembered that inadequacy of the site, wrong location, and environmental defects of the site are among the chief factors of school plant obsolescence. Money for sites should be as well spent as should funds for the building.

Criteria.

Desirably the selection of school sites should be made a part of community planning. For greatest economy in site acquisition experience has proven the advantage of acquiring school sites well in advance of the time of construction of buildings; but regardless of the time of purchase certain criteria for site selection have become well established.

1. Location. An important part of the long-range projection of school plant needs is the study of the characteristics of the population distribution and the factors which may influence residential development and changes in land use in the district. Obviously the school should be located where it will remain a good location through the life of the buildings. With this point in mind, three other factors should be weighed in choosing the location of the school site--centrality, accessibility, and availability of service lines.

   Other things being equal, the site should be so located that the aggregate travel distance within the attendance area is held to a minimum. The location of the site should be such

that the approaches to it are free from undue traffic hazard; and when it is possible without sacrificing other more important factors, it is well to choose a location where power, sewage, and water service lines are available in order to avoid the added cost of line extensions.

2. Environment. Pleasant surroundings give rise to pleasurable and positive responses. The effort and outlay to produce an aesthetically pleasing environment within the school plant may be largely nullified if the school is located in a drab, unattractive area of the community. The area surrounding the school should be zoned to protect the environment against the establishment of commercial and industrial activities to obviate undesirable noise, odors, confusion of traffic, etc.

3. Suitability for the School Program. The outdoor activities of the educational program require many areas that are level and many areas in which a slight grade is permissible. Other things being equal that site is best which already has gradients so that outlay for grading is minimized. Also the nature of the soil with respect to planting and landscaping should not be overlooked.

While not directly related to the educational program, the characteristics of the soil with respect to structural design for the support of the building should be investigated before a site is purchased.

4. Size. There are no established standards as to the size of secondary school sites. The nationwide trend is in the direction of extending the secondary educational program into more outdoor

activities, and hence in the direction of larger sites. The recommendations of the National Council on Schoolhouse Construction as to minimum size of sites are generally accepted, but variations from these recommendations are tending to increase them substantially. The National Council recommends a minimum of 20 acres for a junior high school and 30 acres for a senior high school, plus one acre for each one hundred students enrolled. The area of the site should comprehend possible future increases in school enrollment and building additions.

Organization of the Site

Organization of site space is governed by the same principles and procedures used in organizing the space within the building. The relationship between the indoor and outdoor activities demands that the two be developed together. The plans for site organization should be completed at the time the building plans are developed even though it is known that some parts of the site development may be deferred. Otherwise there is the danger that the building may be so arranged that a maximum and efficient use of the site is handicapped.

An analysis of site use is basic to site organization. A study of site use is the safest method of determining the needed total area which a site should have as well. Specific areas may be listed together with required dimensions and numbers of square feet for the buildings, play areas, areas required for service or protection of buildings and occupants, outdoor educational areas, recreational areas, protective spacing, parking areas, areas for future building expansion, unassigned areas held in

reserve, and service access areas. For organization of the site, it is helpful to make templates for the various areas which may be placed on a plot of the site drawn to the same scale as that of the templates.

Chapter IV. SPECIAL PROBLEMS IN DESIGN AND CONSTRUCTION

Economy

The heart of economy in school plant capital outlay is not how little can be spent, but how much we get and what we get for what is spent. Educational utility is worth what it costs in the competitive market. Getting something that is less useful at a lower price is not a good bargain. Assuming educational utility, economy has meaning in two chief points of reference--initital cost and long-time cost of maintenance and operation. Low first cost contributes to economy only when it does not result either in loss of educational utility or in undue added long-time costs of maintenance and operation. Engineering studies are often necessary to arrive at a proper balance between first cost and long-time costs.

The most important controls of economy lie in the care taken in educational planning--the long-range projection of school plant needs and the formulation of educational specifications for a particular project. The architect is professionally committed to the goal of economy, but his effort may be limited by unwise or careless educational specifications. It is suggested that there should be close cooperation between the educational members of the planning team and the architect during the preparation of the educational specifications and that there should be equally close cooperation between the architect and the educational personnel as the architect formulates his architectural program on the basis of the educational specifications. The presentation of schematics and preliminary drawings affords the best opportunities to check on the architectural program.

In the interest of economy the architect should be given the widest possible latitude and freedom, consistent with the educational utility of

the resulting facilities, in working out solutions to design problems in:

a. The perimeter and shape of the building

b. Modular coordination

c. Economical use of floor space and securing a high percentage of "productive space" in the gross area of the building

d. Choice of materials and methods of construction

Everyone concerned should be aware of the importance, for economy, of having the plans and specifications complete in all details and of having all of the elements of the plans and specifications coordinated prior to bidding.

In addition to the foregoing ideas, boards of education should be aware of other points in school plant capital outlay where decisions may be made to achieve economy. For example:

a. In setting the time for bidding. Bids are lower at seasons of the year or at times when contractors are hungry for jobs.

b. In the program of financing. Interest on bonds is a proper part of the building costs.

c. In providing competent supervision of construction by a clerk of the works.

d. In making sure, through the signed agreement with the architect, that competent consulting engineering service will be used by the architect. The architect should not be permitted to use the services of agent engineers to design important elements of the building; for example, the mechanical and service systems.

Boards of education and educational leaders should be aware of the danger of false economy. Indeed any solution to a design problem which is based upon the idea of saving money should be carefully scanned to make sure that there is no accompanying loss of utility or resulting addition to operation and maintenance. One example of false economy worthy of special mention is the temptation to repeat designs in successive schools in order to reduce the amount paid to the architects. On its face

this is poor practice. In effect such a practice nullifies the chief reason for employing an architect. Not only is his creative talent blocked, but he is thereby barred from taking advantage of current improvements in materials and construction methods. Moreover it is not possible to take advantage of experience with any given design for space organization to effect adaptations and improvements. The perfect building has never yet been planned. Improvements of previous design solutions are always possible. Finally, it should be remembered that architects' fees constitute a relatively small expenditure, particularly if prorated over the lifetime of the buildings which he designs.

Increasing Utility Through Flexibility of Design

Increasing the educational utility of school buildings through the application of the principle of flexibility in the organization of space was treated above in Chapter III. Following are some ideas regarding the application of the principle of flexibility to structural design. Of course the two applications must be considered together. For example, the spatial approach to school building design starts with a conception of the program of activities to be carried on, and hence with the kinds and amounts of space needed and their organization; but the building envelope and internal walls not only define the perimeters of the various spaces, they are important means for controlling the visual, auditory, and thermal environments. The walls also provide surfaces for instructional equipment and activities as well as storage facilities, the arrangement of which affects the freedom with which the space may be adapted for various activities.

The structural design of the school building should allow for the ready and inexpensive alteration of the internal spaces within the building

envelope. The reference point always is the educational utility of the spaces; flexibility is not the ultimate end; but consideration should be given to the location of bearing walls and the placement of mechanical and service systems. The type of material used in curtain walls is related to the ease of altering the size and dimensions of rooms.

The design for natural lighting is also critically related to flexibility. For example, if the sole function of sidewall windows is for visual connection between the interior and exterior, and natural light is introduced from overhead, the banks of artificial lights can be placed vertical to the exterior wall according to modules rather than horizontal; and switches and outlets need not be altered when the rooms are changed in dimension.

Structural design should allow for expansion of the building. Corridors should extend to the building perimeter or at least be dead-ended against a space through which the corridor may be extended without reducing the space to the point where it may not be useful.

With respect to possible future expansions or additions one critically important point should not be forgotten in the design of the initial unit of the building. It is this. In the design (space organization and structure) of the first unit, the completed or ultimate building should be projected at least in single line drawing. The amounts and kinds of spaces needed and the organization of space in the ultimate plant must influence the design of space in the first unit. Unless the projection is made, there is the real danger that ultimate space organization will be awkward and that certain spaces may be inadequate or omitted. Particular attention should be paid to the capacity of the mechanical and service systems so that they will be adequate for the ultimate plant. The same

is true for the capacities of general and special-use facilities to be included in the first unit (for example: administrative and service areas, auditoriums, gymnasiums, and related areas).

Visual Environment

Awareness is increasing of the relationship between the quality of the visual environment of the learning process and the learning achievement of school children. It is becoming recognized that ease in seeing, or visual comfort, depends primarily upon the quality of the visual environment rather than upon the mere quantity and distribution of light.

Traditionally, the design for school lighting has been concerned primarily with the quantity of light expressed in foot candles. In the recent past increasing attention has been given to the problem of controlling excessive brightness of surfaces within various "visual fields" within the classroom. At the present time this effort to control brightness has reached the point where the concern is for the quality of light in the total visual environment of the classroom. The critical unit of measurement in determining the quality of light is the foot lambert. The light quality depends upon holding the foot lambert brightness of the various light emitting and light reflecting surfaces in the total visual environment within acceptable ratios of contrast.

We are in a period of extensive experimentation in the design for school lighting. Ideas are still fairly fluid even in the design for the quantity of light where many ideas in design have been tried and proven; but ideas are as yet relatively few in the design for controlling light quality. In this bulletin, the position is taken that further

experimentation, especially in design for assuring visual comfort, should be encouraged--experimentation based upon careful engineering and cost studies looking toward the achievement of the "goals" listed below. These goals should be sought wherever critical seeing tasks are performed.

The National Council on Schoolhouse Construction has announced seven goals with respect to brightness contrasts within the total visual environments as follows:[4]

Goal A - The foot lambert brightness of any surface viewed from any normal standing or sitting position in the schoolroom should not exceed ten times the foot lambert brightness of the poorest lighted task in the room.

Goal B - The foot lambert brightness of any surface viewed from any normal standing or sitting position in the schoolroom should not be less than one-third the foot lambert brightness of the poorest lighted task in the room.

Goal C - The foot lambert brightness of any surface immediately adjacent to the task should not exceed three times the brightness of the task.

Goal D - Brightness difference between adjacent surfaces should be reduced to a minimum.

Goal E - The brightness goals stated above assume a lighting system that provides from twenty to forty foot candles on the poorest lighted task. As foot candle levels are increased, sources of high brightness should be controlled to approach more nearly the brightness of the task.

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[4] Guide for Planning School Plants. National Council on Schoolhouse Construction, Revised 1953, pp. 156-157. W. D. McClurkin, Peabody College, Nashville, Tennessee. Also Common Sense in School Lighting. The American Association of School Administrators, 1201 16th Street N. W., Washington, D.C.

The extent of the area of the surface producing brightness has a measurable effect upon visual comfort. Generally, small areas of either extremes of brightness are less noticeable than large areas of the same brightness.

Goal F - Light distribution from any light source should be of such a nature that direct glare and reflected glare are eliminated for the observer to the greatest degree possible.

Goal G - These objectives or goals should be achieved without the loss of a cheerful, friendly, and aesthetically pleasing classroom environment and with the need in mind for a balanced and acceptable thermal and auditory environment.

Terms Used in Lighting.

Foot Candle - Illumination of a surface one foot from light source of one candle.

Foot Lambert - The product of illumination in foot candles and the reflection factor of a surface. Candles per square inch is the unit of brightness of a light source, but for calculating brightness balance in the visual environment it is simpler to use the foot lambert unit for both light-emitting and light-reflecting surfaces. (The brightness of a light-emitting surface may be translated into foot lamberts by multiplying candles per square inch by 452.)

Brightness - Luminous intensity of any surface.

Reflection Factor - Foot candles reflected by a surface divided by the foot candles falling upon the surface (expressed as a percentage). This is an important factor to consider with respect to both light distribution and brightness balance.

Psychological Factors in School Lighting.

The quality of the visual environment in school buildings has a

profound psychological impact upon their occupants. Visual comfort or ease of seeing reduces tension as well as anatomical and physiological strain. The energy output for critical seeing is determined in large part by the quality of the visual environment.

The design for school lighting inevitably contains certain elements of considerable psychological importance over and above their effect upon seeing ease. Some of these elements are mentioned here as a reminder to consider them in the design for school lighting.

It is important to provide visual connection between the inside and outside of instructional spaces in the school building at normal seeing levels. If the design relies completely upon overhead lighting (either natural or artificial) rather than upon side wall fenestration, it is desirable to provide visual connection with the outside by vision-strip windows.

The color treatment of instructional spaces has psychological values beyond its effect upon brightness balance and light distribution. The reflection factor varies according to hue and type of finish and hence affects the quality of the visual environment as defined in the "goals." The rules are well known and need not be repeated here for controlling the reflection factors of major surfaces in the room to gain maximum light distribution, and for controlling acceptable brightness ratios among both major and minor surfaces.

It is possible to give this relationship full weight and still vary the color treatment of the many spaces to realize the psychological values of attractiveness and cheerful color climate. Variety from room to room is considered by many to be important. Variety in color treatment can be had at little, if any, additional cost. Accent colors, if confined to small

areas, can be used to punctuate mass colors without destroying brightness ratios.

The rules for color treatment are also well known, but a brief summary of major points may be in order. Seagers uses the following popular terms to classify colors: stimulating, relaxing, neutral, depressing, warm, cool, approaching, receding.[5]

Colors may be selected for treating various rooms according to their location or orientation, their size or shape, or according to the nature of activities to be carried on in them. Spaces in which relatively little natural light enters may be treated with warmer colors. Conversely, rooms having more natural light and warmth may better be treated with cooler colors.

Smaller rooms may be treated with receding colors and large rooms with approaching colors. Stimulating and relaxing colors may be varied in their use according to the nature of the activities to be carried on in the spaces. The apparent shape of a room may be altered by the use of approaching and receding colors.

Reds, oranges, and pinks are both warm and stimulating. Blues and greens are cool and relaxing. Grays generally are neutral, while most purples are depressing. A cool tint is most receding and warm saturated colors are most approaching.

Thermal Environment

It is well known and generally recognized that the thermal environment in the school has a direct and positive bearing upon the health and body comfort of the occupants, and hence upon the learning and accomplishment

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[5] Developing The Color Treatment for School Rooms, by Paul W. Seagers, Illuminating Engineering Vol. XLVIII, No. 6, June 1953, pp. 296-298.

of pupils. The heating and ventilating sytems of the school are the chief means for controlling the thermal environment.

It is recommended that the heating and ventilating systems for each school be designed by competent, consulting (non-agent) licensed engineers. The design should strive for simplicity and economy of operation along with adequacy. The type of system adopted should be determined by engineering study which takes into account the size and type of school and its arrangement on the site, and the local climatic conditions (temperature extremes, exposure to prevailing winds, etc.). Heat loss from the building through exfiltration within the range of outside temperatures must be calculated along with the temperatures to be maintained in the various kinds of spaces in the building in order to determine the required capacity of the heating system. Another item to be considered in determining the capacity of the heating system is the likelihood of future expansion of the school plant.

The type of heating system adopted may be any one of the following, depending upon the engineering study referred to above:

1. Direct radiation.
2. Unit ventilators.
3. Warm air furnace systems.
4. Forced air systems.
5. Radiant panel system.
6. Split system.

Automatic control of the heating system is essential. Preferably there should be individual room control. In school plants having facilities which may be used during non-school hours, the heating system should be so zoned that only the spaces to be thus used need be heated.

The heating system should provide controlled room air temperatures as follows:

a. Instructional spaces of sedentary to moderate activity - 68°- 72°

b. In corridors and spaces of moderate activity - - - - - - - 66°- 70°

c. In spaces of vigorous activity - - - - - - - - - - - - - - - 60°- 70°

The type of ventilating system adopted must, of course, be consistent with the type of heating system used. Within the latitudes and climatic condition of Utah a mechanical system may be considered necessary. The amount of outdoor air which should be supplied may vary according to the type of space.

It is recommended that in regular classrooms and libraries, the supply of outside air should range from 10 to 15 cubic feet per minute per pupil depending upon outside temperatures. Many other spaces in the school buildings have special ventilating problems. For example, auditoriums or other rooms in which large groups assemble (50 or more) mechanical ventilation should provide not less than eight air changes per hour. Toilet rooms, kitchens, or other rooms producing odors should be provided with positive ventilation through independent exhaust ducts. (For such spaces the rate of air change may desirably be increased to as many as twelve changes per hour.) Wardrobe spaces or facilities, especially if located within classrooms, should be provided with ventilation through grills or exhaust ducts.

Climatic factors in most of the state are such that reasonable thermal comfort may be achieved by controlling air change and air movement (and heating, of course, during warm-up periods in cold weather.) Air conditioning through filtering and humidifying may be unnecessary. However, cooling is a year round problem. The trend now is toward designing

the ventilating system for cooling beyond that which takes place through air change and air movement.

Anticipation of summer time use of school facilities suggests the wisdom of making the original design include pipes and ducts dimensioned to carry the burden of cooling at such time as decision may be made to make use of the facilities during the hotter periods of the year.

The proper insulation of school buildings is an important factor in the control of the termal environment of school buildings. It is of critical importance both in the control of solar heat and in the prevention of excessive heat loss. Insulating materials serve as well to control troublesome condensation. Engineering study should determine the type and extent of needed insulation for the type of building and the local climatic conditions.

Auditory Environment

Hearing ease is critically important to the effeciency of the learning process. The control of noise is not difficult. It may be accomplished in part by space organization and in part by acoustical treatment. Of course, the first step in noise control may be taken when the school site is selected. Noises of rail or highway traffic and noises of industry may be controlled only by locating school sites to avoid them.

Space organization is a key to noise control. Noisy spaces should be relatively isolated. Outside play areas should be located away from the sides of classrooms through which noise is transmitted.

Within the school building the spaces should be conditioned for sound absorption by acoustical treatment. Certain large spaces, or spaces in which public performances may be carried on (for example, auditoriums,

music rooms, and multi-purpose rooms) should be treated according to acoustical engineering studies which may influence structural design as well as acoustical treatment of surfaces. Any fees paid to acoustical engineers are a good investment.

Ease of hearing or auditory comfort is of primary importance in classrooms and libraries, but trial and error methods have been used to such an extent that for these spaces experience has pointed to fairly satisfactory solutions. Acoustical treatment may be confined in these rooms to applying sound-absorbing ceiling surfaces only. The same is true for corridors.

Design for Safety

It is assumed that the structural design of school buildings will be in accordance with generally recognised and observed safety factors. It is also assumed that supervision during construction will make sure that specifications are strictly carried out. It is recommended, however, that preliminary to the final structural design, a competent foundation investigation be made by engineers professionally qualified by training and experience to make foundation investigations.

In addition to structural safety, the building should be designed to reduce to a minimum the hazard of accidents to the occupants. One-story buildings are safer than multi-story buildings. They allow faster evacuation and avoid the safety hazards of stairs and ramps. Corridors and passageways should not be dead-ended; their width should be calculated in terms of the maximum traffic load for any part of the school day. Projections into corridors should be avoided.

Main exterior doors used by pupils should be equipped with panic bolts which are maintained in good working order. Projections into spaces used for play or gross physical activity should be avoided (e.g. serving counters from kitchens, heating units, etc.). Separate storage space should be provided for chairs or tables which may at times be used in the space.

If the structural design should include ramps, the pitch should not exceed one foot in eight. The floor finish should be of a material which is slip-resistant. Entryways subject to accumulated moisture should have floor finish which does not become unduly slick when wet (e.g. quarry tile).

Planning for Operation and Maintenance

Much can be done on the drawing boards and in the formulation of specifications to simplify and make easier the operation and maintenance of school buildings. To be sure, school buildings are planned primarily for their educational utility--for efficiency in facilitating the educational program; but school buildings must be operated and maintained too, as any operating budget will attest. Ease of operation and maintenance (and hence low long-time cost) can be had without sacrificing utility. Another value besides low-operating cost, good housekeeping, should result from planning with an eye to ease of operation and maintenance.

Solutions to the problems of maintenance and operation may be developed at numerous points in the preparation of plans and specifications. This is notably true in the plans for space organization and structural design, the specifications for materials, and the specifications for mechanical and service systems. The suggestions made below are but a few examples of the many solutions which must be made regarding ease of operation and maintenance.

1. Space Organization

a. Provide adequate space and facilities for the custodial staff--service sinks and storage at convenient locations; work and repair room with suitable benches, tools, equipment and storage; adequate receiving room with convenient, sheltered unloading dock.

b. Convenient service access for deliveries to the building.

c. Convenient access to service systems for repair and maintenance.

d. Provide for isolation of spaces to be used during non-school hours.

e. Provide for proper drainage and for walks and surfacing near building entrances to avoid carrying excessive dirt into the building.

f. Avoid as far as feasible enclosing small spaces hard to clean; also non-functional recesses adjacent to fixtures and equipment.

2. Structural Design

a. Avoid intricate surfaces hard to clean and paint.

b. If pipe tunnels are included, make them easy to travel in and provide occasional electric outlets. Make service systems easily accessible.

c. Keep floors to toilet rooms free--e.g. wall suspended water closets, ceiling hung stalls.

d. Avoid placing light-transmitting media on the horizontal.

e. Keep exterior surfaces which require painting at a minimum.

f. Insofar as possible, plan the glazing design in terms of uniform sized elements.

g. Provide interior down spouts for roof drainage with proper sumps.

h. Provide for convenient, sanitary refuse disposal.

3. Materials

a. Use flooring or floor finish materials suited to the activities to be carried on, but durable and easy to keep clean--e.g. grease and moisture resistant in kitchens and dining areas and acid resistant in chemistry rooms, impervious tile in toilet rooms; molded durable base to withstand impact and avoid sharp angles hard to clean.

b. Provide durable, easily cleaned surfaces on walls subject to impact--e.g. glazed structural tile or smooth-face brick which will require infrequent re-sealing.

c. Specify stainless steel, or at least structural tile sight blinds in toilet rooms.

d. Provide floor-to-ceiling glazed surfaces on exposed walls in kitchens and toilet rooms; also moisture resistant ceiling surfaces.

e. Specify metal exterior doors, aluminum window sash.

4. Mechanical and Service Systems

a. Make certain that these systems are adequate in capacity and performance; of durable materials and simple to operate; and installed so that replacement is relatively easy.

b. Specify vitreous china fixtures--water closets, drinking fountains, lavatories, urinals.

c. Make sure that electric circuits in kitchens are suited to the equipment to be installed, or which may be installed in the future.

d. Provide sewage disposal pipes from kitchens resistant to cleaning chemicals.

e. Provide floor drains in all spaces where floor cleaning can best to done by flushing.

Sanitary and Plumbing Facilities

The National Council on Schoolhouse Construction recommends a supply of safe and palatable water for a school of at least 25 gallons per pupil per day for all purposes. In rural localities where the water mains are either not adequate or unavailable at the school site for firefighting, provision should be made of special storage facilities on the site for this purpose. The Utah State Department of Health, Division of Sanitary Engineering, should be consulted on matters regarding water supply for schools.

It is recommended that the educational specifications for secondary schools include provision of sinks with hot and cold water in some classrooms to allow the use of paint, paste, etc. in making charts, posters, and displays. Tempered water should be supplied to all lavatories wherever located. The tempering may be done by installing mixing valves on the lavatories.

Toilet Rooms. Toilet rooms should be located at convenient places in the school building to minimize traffic. In combination elementary-secondary schools toilet rooms should be designed and located to provide for separate use by the students of different age levels. It is desirable to locate toilet facilities for convenient access from outside play areas. The toilet rooms should be large enough to accommodate the required number of fixtures for convenient use. A minimum width of ten feet is considered necessary with an additional 30 inches beyond the wall back of the main fixtures for plumbing and service. Natural light is desirable. Entrances should be provided with sight blinds.

The floors of toilet rooms should be of an impervious material to allow easy cleaning and the non-retention of odors. Walls should have a glazed finish. Floor drains and hose bibs should be provided. In boys' toilet rooms floor-type urinals may serve as floor drains.

Ventilation in toilet rooms should be positive and mechanical with separate exhaust ducts. Stall partitions should be substantial and firmly anchored. If metal, the finish should be of good quality baked enamel. Ceiling suspension, properly designed, to ease cleaning of floors may be satisfactory. Marble stall partitions, firmly anchored, are satisfactory. Soap dispensers, toilet paper holders, and hand drying facilities should be chosen in terms of convenience, durability, and operation cost. Mirrors should be installed on walls apart from the lavatories. In girls' toilet rooms at least one full length mirror should be provided.

Fixtures. It is recommended that the number of fixtures should at least equal the ratios given below which coincide with the recommendations of the National Council on Schoolhouse Construction. In applying these ratios consideration must be given to their location with respect to the number of students in the respective parts of the school plant who will be using them.

a. Water Closets - one water closet to each 40 girls; one water closet to each 80 boys. (Wall mounting is desirable.)

b. Urinals - one urinal for each 30 boys.

c. Lavatories - one lavatory for each 50 students, mounted 30 inches from the floor. Tempered water through one spigot. Stoppers in the basins are not necessary.

d. Drinking Fountains - one drinking fountain for each 75 students. If installed in corridors, it is desirable to provide full recess

for the fixtures (this includes cooling facility where used). Frost proof fountains should be installed in outdoor play areas. Drinking fountains should not be attached to sinks nor located in toilet rooms. The nozzle should be of a type to prevent contact with the mouth and not to allow water to fall back onto it from the lips. Recommended heights of drinking fountains are 32 inches for junior high schools and 36 inches for senior high schools.

e. Sewage Disposal - the plans and specifications for sewage disposal facilities should take into consideration possible future expansion of the plant. In cases where sewage disposal must be provided independent of satisfactory municipal systems, it is necessary that the Utah State Department of Health, Division of Sanitary Engineering, be consulted. If septic tanks are used, the acid proof drain from science units should be designed to flow into a separate "dry well." Grease traps should be provided in kitchen drains.

f. Miscellaneous - long-range economy calls for the installation of piping sized to serve any future expansion of the plant. The pipe should be non-corrosive in terms of local soil conditions. Acid proof drains should be used where need is indicated. Valves and fittings should be of high quality and tagged for identification. The custodian should have a chart of the plumbing system. Hose bibs outside of the building should be designed for convenient use in landscaping care.

Decoration

One of the basic educational needs of children is to have beauty in their lives. The child's ability to see and appreciate beauty is nurtured

by his surroundings. Since the child spends a major portion of his time in the schoolhouse, should not the school contribute to this understanding of beauty? Why not have the school be the place where he meets this need. Here he can be taught to understand and appreciate it.

This beauty need not be expensive. It can be accomplished by relating the school building to its natural surroundings by proper use of materials and exploitation of their textural relationships. It can be accomplished by proper attention to such things as space, buildings, masses, proportion, color, and lighting. A good school plant should be one that attracts beauty in and of itself, and because of this, transmits beauty into the lives of the children who attend it.

The aim should be to integrate art and beauty throughout the building, rather than including it reluctantly in isolated areas. Color is the most versatile and economical means of integrating beauty into a structure. In too many cases, bare empty spaces in school buildings cry for the aesthetic touch of the painter or sculptor. By the use of color, painters and sculptors attract and involve the observers and integrate them into the building. We should, then, in our buildings, seek the type of beauty that excites the emotions and the imaginations of the students and challenges them to activity and exploitation of their abilities.

Much attention to minor details such as floor finishes, furniture, and equipment, woodwork, chalk and tack boards, pictures, and color schemes all should be incorporated into the total aesthetic appeal of the school plant.

Chapter V. BUILDING SPACES

In this chapter the various spaces in the secondary school building are treated. In general the spaces which are given comprehensive treatment in separate publications of the School Plant Planning Series are dealt with briefly in this chapter. The spaces for which no separate brochures have been prepared are given more detailed and comprehensive treatment herein.

The treatment of the various spaces which follows is intended to provide points of reference for the formulation of the educational specifications. The recommendations made should not be considered to be standards to be observed slavishly.

A. School Offices. Offices should be provided not only for the general administration of the school, but for teachers or other employees whose main working space is not suited to record keeping and essential deskwork; for example, physical education and shop teachers and custodians; also teachers whose classrooms are not available to them during non-teaching periods. Needless to say, such offices need to be planned with respect to size, location, and equipment to meet specific and identified needs.

B. Administrative Suite. The major activities for which administrative facilities should be planned include the following:

1. Organizing and Planning the instructional program including class schedules.
2. Supervising instruction.
3. Planning and managing student activities.
4. Keeping student records.

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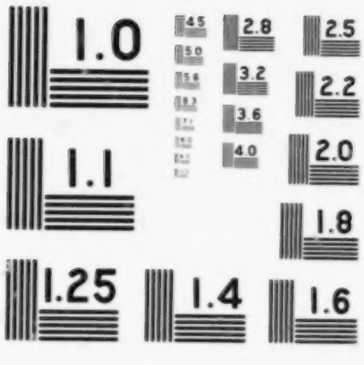

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963

5. Conferences with students, teachers, the public.
6. Storage and management of books and supplies.
7. Dealing with health problems--medical examination, isolation of sick or injured students pending disposition.
8. Personnel management of students, including attendance, work permits, etc.
9. Communications, including receipt and distribution of mail, correspondence, mimeograph, intercommunication within the school plant.
10. Filing of correspondence and business records.
11. Storage of cloaks and wraps of administrative and office staff.
12. Storage and management of keys.
13. Schedule and alarm signals.
14. Display.

The administrative suite is the focal point of all that goes on in the school plant. In its planning, consideration should be given to making it accessible to those who come to it both from within the school plant and from outside. Also its various spaces should be organized with chief reference to functional affinities. It should not be forgotten that the administrative facilities may be used at times when the rest of the school plant is unused. In determining the initial numbers, sizes, and arrangement of the various spaces and facilities of the administrative unit, full consideration should be given to possible future enlargement of the school.

Special attention should be given to the design of the visual, thermal, and auditory environment of the administrative suite. Also, particular emphasis should be given to making the unit attractive. A climate of relaxation should be created in offices and waiting spaces. Spaces should be organized to facilitate the circulation and minimize traffic.

Depending upon the size of the school, the activities listed above may call for varying numbers of separate spaces. The smaller the school the more it will be necessary to combine activities in a smaller number of spaces. The spaces needed include the following:

1. General office (size to be determined by the number of employees to work in it and by the equipment to be installed).
2. Waiting space.
3. General office supply room.
4. Record vault.
5. Work room for duplicating activities.
6. Office for principal--offices for assistant principals.
7. Storage room for school supplies.
8. Storage room for books.
9. Conference room.
10. Space for console and public address control.
11. Office and waiting space for attendance employee.
12. Facilities for staff comfort and convenience.

C. Faculty Facilities. Teachers' lounge and restroom facilities may be provided separately for men and women for joint use or both. The location should be reasonably central in the school plant. The space should be both attractive and quiet and furnished for rest and relaxation. Storage facilities for books and magazines and writing materials should be provided along with facilities for clothing and other personal belongings. A kitchenette in the unit is a useful facility. Where a lounge is jointly used by both sexes, toilet facilities should be so located that they may be used without restraint or embarrassment.

In addition to lounge and restroom facilities the provision of one or more teachers' workrooms is often desirable. It is convenient to locate the workroom near the main supply room. A sink and adequate working surfaces should be provided. Duplicating equipment and a typewriter may also be included in the facilities as well as assembling equipment, staplers, cutters, etc.

D. Health and Isolation Facilities. The degree to which the school provides health services to students will determine the nature and the most convenient location of the facilities. It may be that if the only medical examinations provided are those for school athletes, the most convenient location for the physical examination rooms would be within the physical education unit.

Isolation and rest facilities should be provided for students who become ill or who sustain injury after arrival at school. Separate spaces for boys and girls are desirable. Toilet facilities and lavatories should be included within the isolation units. It is generally most convenient to locate the isolation spaces within the administrative suite because of the need for communication outside the school in making proper disposition of sick and injured students. Also, the continued presence of some responsible adult in the administrative suite makes it easier to provide needed supervision.

E. Guidance Facilities. While some of the activities of the organized guidance program of the secondary school take place in various areas of the school in relationships between teachers and students, yet the total program centers in the facilities of the counseling suite. Many of the more important guidance activities are carried out within these facilities. Following is a list of categories of these activities:

Counseling and interviewing.
Testing (administering and interpreting).
Case study and case conferences.
Maintaining cumulative counseling records.
Gathering occupational and educational information.
Placement.
Follow-up.
Conferences with teachers and parents.

The counseling suite should desirably contain the following spaces:

1. Reception and waiting space. A school large enough to justify a full or part-time receptionist-secretary should provide working space to accommodate a desk, typewriter, telephone, record files, etc. The waiting space should be sufficient to accommodate from two to four comfortable chairs, a table for books and magazines, bulletin board, etc. Telephone service to the counseling suite should desirably be independent of the switchboard in the administrative suite.
2. Private counseling offices insulated for sound to prevent transmission of counseling interviews are desirable. The number of such offices to be provided depends upon the size of the school, but in general there should be a minimum of one counseling office for each 350 students. Each such space should be informally furnished. A desk, filing cabinet, bookcase, and telephone are essential.
3. A conference room large enough to accommodate groups up to 18 persons is desirable.
4. A testing laboratory with individual working surfaces for the administration of paper and pencil tests to groups as large as 20 students. Also, there should be space and working surfaces for the administration of individual performance tests.

5. Storage facilities for tests and testing equipment, as well as for occupational and educational information source materials and professional library.

The counseling suite may best be located near enough to the administrative suite to allow convenient access to cumulative student records; but this affinity is not as important as the distinct separation of the counseling and administrative suites. It should be remembered that the relationship between students and counselors is essentially voluntary and permissive.

It is a handicap to counselors in establishing those relationships if the counseling facilities are so located or integrated with the administrative suite that the counseling facilities run the risk of taking on any of the administrative aura. In other words it is a good investment to organize the space in accord with the foregoing concept.

It is important also to conserve the investment in counseling facilities by designing the quality of wall and floor finish and by specifying furniture which will create an attractive and pleasant environment and a climate of relaxation.

F. Student Activities Facilities. It is desirable to provide facilities for important student activities. These include:

1. Student government (councils and committees).
2. Student publications (newspaper, yearbook, handbooks, programs for special events, etc.).

The number and arrangement of the rooms should be determined by the size of the school. The rooms for meetings of student government groups should be attractive and pleasing and informally furnished. Some chalk and bulletin board should be included with storage facilities for records of proceedings.

The room, or rooms, for publications should be large enough to accommodate a table of substantial size and other working surfaces for layout work. Chalk board (possibly 8 lineal feet) and tackboard (possibly 12 lineal feet) should be provided. A sink with hot and cold water is important as well as several electrical outlets. It is not uncommon to include a darkroom for photographic work immediately adjacent to the publications room.

Display facilities, including picture hangings and cases, are desirable. Bookcases should be included; also, a storage closet for clothes and adequate filing facilities for records and for publications materials.

G. Custodial Facilities. The efficient operation of the school plant is critically important to the effective operation of the educational program. It is a significant budgetary item as well. In general, about five per cent of the total school budget is used up in charges for operation of the physical facilities. For these reasons it is good sense to plan with much care the facilities needed by the custodial staff.

Here again the size and number of specific spaces and their arrangement provided for the custodians should be determined by the size of the school. No mention is made here of spaces required for the heating and ventilating system. It is assumed that they will be designed by engineers to satisfy the demands for the proper control of the thermal environment as outlined in Chapter IV, above. The facilities needed by the custodians are outlined below:

1. Custodians' workshop and storeroom. This room should be designed to serve the needs of maintenance crews in repairing and servicing

the heating, ventilating, electrical, and water service systems as well as the routine repair tasks performed by the custodial staff. It should normally be equipped with heavy duty work bench, heavy duty steel counter, steel shelves, steel racks for lumber and pipes, tool boards, and bins. The usual bench tools should be supplied along with such items as emery wheels and drill press.

2. Receiving and shipping room. This room should be readily accessible to vehicular traffic and should be so located that it is adjacent to the main supply room. It should contain storage for tools used in crating and opening crates as well as for the materials used in shipping.

3. Custodial locker room. This unit should contain lockers and dressing space, toilet facilities, and shower.

4. Storage room for oil, greases and paint. Shelving for paint, oils, and greases should be provided along with floor space for larger drums. The design should contemplate free movement of trucks and dollies. Racks for step ladders should be included.

5. Janitors' closets. Closets with service sinks and shelving and racks for the convenient storage of cleaning supplies and equipment should be provided for the custodial workers throughout the building at locations to minimize walking distances.

6. Custodial office. An office for the custodian should be provided and equipment to facilitate the making and filing of reports, requisitions, and records.

7. Furniture storage room. It is desirable to provide a room of substantial size for the storage of school furniture. It should be located near the main receiving room.

8. A storage room opening directly to the outside should be provided for the storage of equipment used in landscaping and snow removal.

9. Miscellaneous custodial facilities. An incinerator should be made readily accessible, but so located as to minimize fire hazard. Meter and switchboard facilities may be located in separate rooms, but attention should be given to making them readily accessible.

INSTRUCTIONAL SPACES

A. Language Arts, Social Studies, Mathematics Classrooms. In the design of classrooms decisions should be made concerning the degree to which the curriculum may be organized to cut across traditional subject lines now or in the future--for example, the core curriculum concept. Also, modern methods of instruction should be provided for in the large classrooms and varied instructional materials and equipment required. Provision of a conference room with visibility between it and the classroom is a contribution to newer teaching methods.

Typical student activities include the following:

1. Planning activities--deciding on problems to be explored and work to be done, and analyzing approaches to be made, materials and sources to be utilized.
2. Arranging for resource persons, records, films, and needed materials. Making individual and committee assignments. Scheduling trips and sending requests to business or government sources.
3. Committee work, including the preparation and presentation of committee reports.
4. Individual and group research, including the use of library resources.

5. Reading.

6. Listening.

7. Using visual aids--films, film strips, slides, charts, etc.

8. Observing demonstrations.

9. Practicing--oral and written applications of rules, vocabulary, and processes.

10. Summarizing and reporting--oral and written reports. Panel discussions. Preparing materials for school publications.

11. Preparing and displaying charts, graphs, models, clippings, pictures, samples of materials used in study and research activities, examples of students' work, completed projects, etc.

Typical activities performed by the teacher include the following:

1. Planning with students, and planning his own work.

2. Presenting ideas and discussing problems with committees or the entire class, using chalk board, charts, maps and other visual aids.

3. Keeping student records and making reports.

4. Evaluating and testing the work and progress of individual students.

5. Assembling resource materials.

Classrooms designed for efficient and effective operation of the foregoing student and teacher activities must be of good size (possibly 900 square feet of floor area) and must have an abundance of tackboard and display facilities. A sink with hot and cold water is recommended in classrooms where materials will be manipulated in creative or illustrative work. The teacher should be provided with filing

facilities, chair, and desk. Student furniture desirably should be individual, flat topped, without book receptacle, light and durable. If it is designed so that it is stackable, there will be greater flexibility in use of the room. Two or more pieces may be placed together when a larger working surface is needed. It is desirable for seats also to be light, durable, and stackable. At least one work table of good size should be provided. The casework should be designed for display and for storage of instructional materials; also bookshelves, magazine racks, dictionary stand should not be overlooked.

The foregoing discussion of classrooms is particularly pertinent to social studies and language arts. It is likely that a somewhat larger emphasis may be given to the provision of chalk board in classrooms used for mathematics; also, special storage for instruments and demonstration items and for materials used for creative, kinetic teaching. In classrooms used for speech, it has been found desirable to provide an elevated platform in one end of the room. The design should provide electrical facilities and light control for use of audiovisual aids and tape recorder.

B. Science Rooms. It should be recalled that by decision of the State Course of Study and Textbook Commission, it is required that general science be offered in the junior high school curriculum and that biology, physics, and chemistry be offered in the senior high school curriculum. Other science courses commonly offered in the curricula of larger senior high schools include botany, zoology, earth science, and physiology.

In smaller senior high schools some science courses may be offered on alternate years. Also, the number of sections of each science

course may be limited. Therefore, it is necessary to design the science units so that they serve equally well for two or more different subjects. In such instances it is usually necessary to provide a proportionately greater floor area in order to accommodate the specialized equipment and storage facilities required for the several subjects to be accommodated.

The activities of science rooms are similar to those of other classrooms, but students generally assume less responsibility for initiating the planning of the activities. However, there is correspondingly greater emphasis upon creating and individual experimentation. Emphasis is also greater on display and on observation of demonstrations.

Critical points in the educational specifications for science facilities other than amount of space include: the provision of auxiliary rooms, storage, key case, display, utilities (water, electricity, gas, compressed air, antenna and wiring for radio and television). Physics and chemistry rooms should be provided with both alternating and direct current. Electrical outlets for the use of microscopes should be provided at all student work stations. Storage for chemistry notebooks should be included. Science rooms should be designed for darkening.

The trend in the design of space for science units in senior high schools is away from providing separate rooms for lecture and laboratory. The practice most common now is to include all activities within one room, arranging student experiment stations around the periphery and providing student furniture for group discussions in the center of the room in front of the teacher's demonstration desk. Such arrangement is more economical in capital outlay. Supervision and direction

of activities by the teacher are easier.

It is advantageous to locate the different science rooms adjacent to or near each other. Economies may be had in providing utility service lines and in making multiple use of common instructional equipment. Science rooms desirably should have outside entrances or be close to building exits to facilitate bringing materials in and to allow quiet exit of students for field trips and to provide convenient access to outside gardening and growing areas. Orientation with respect to sunlight should also be given due weight in locating science rooms. A combination of northern and western or northern and eastern exposure may be best. Ground floor location is probably most advantageous.

Safety should be given special consideration in the plans for science facilities. The following provisionsshould be made:

1. All gas, water, and electricity lines should have master shut off devices within the science unit, and located so they are accessible to the teacher only.
2. Secure, lockable storage should be provided for dangerous equipment and supplies.
3. Electric motors and generators and air compressors should be protected by a guard rail or placed in a separate room.
4. The total space should be so organized as to provide a clear view to all areas occupied by students.
5. A good first aid cabinet should be located in each science room and kept well supplied.
6. One or more fire extinguishers suitable for the kinds of fires most likely to occur in science rooms should be provided.

1. Auxiliary Rooms. In addition to the regular science rooms, there

is need for such auxiliary rooms as preparation rooms and special storage rooms.

The preparation room is sometimes called the project room. In it material and equipment are assembled and organized for various classes throughout the day. As need arises experiments or demonstrations may be left up for several days. This room may provide the space and facilities for special activities and for student projects and research. In biology or general science units the preparation room contains a growing or germination bed in addition to other facilities. In the preparation of educational specifications for the preparation room, the following should be considered:

a. A working surface, resistant to chemicals, with drawers for small repair parts and supplies.

b. A chemical resistant sink with both hot and cold running water.

c. Conveniently located alternating and direct current electrical outlets.

d. Conveniently located gas outlets.

e. Adjustable shelving.

f. Forced ventilation, particularly for the chemistry unit.

g. Visibility between the preparation room and the science room. Separate storage rooms should be provided for scientific apparatus and for supplies. Dutch doors into the science rooms and separate doors into corridors are desirable. Forced ventilation should be provided in storage rooms. In the apparatus and instrument room there should be some open and some enclosed shelving.

The shelving should be adjustable. Drawers for small equipment and supplies may be provided. Corrosive chemicals should never be stored in spaces occupied by scientific instruments.

Another auxiliary room which is frequently provided in the science unit is a photographic darkroom containing a sink with hot and cold water, suitable working surface, and storage facilities for supplies and equipment.

C. Business Education Rooms. The business education program, depending upon the size, type, and location of the secondary school, may include any or all of the following:

Typewriting
Shorthand Transcription
Shorthand
Bookkeeping
Office Practice
Distributive Education
Retail Selling and Merchandising
Machine Calculation

In planning business education rooms, it may be feasible to combine into one room two business education courses (for example, shorthand and transcription), but it is generally unwise to combine a business education course with non-business education classes. The space of business education rooms should be designed in terms of the furniture and equipment to be installed and the instructional methods to be used. The rooms should contain sinks and lavatories. The design of storage for books, supplies, and equipment is of critical importance and should be given special consideration in the educational specifications, as should the amounts of chalk board and tack board. The latter is particularly important. An adequate number of electrical outlets should not be overlooked.

The typewriting room should be equipped with individual typewriting desks (either adjustable or of varying heights) and adjustable posture chairs. Elite-type typewriters of at least two brands should be provided. There should be a teacher's desk of substantial size and a comfortable chair. The equipment should include letter-size filing cabinets and such items as paper cutter, stapler, stop watch, interval timer, and demonstration stand. A room 30 by 40 feet will accommodate a class of normal size.

Students taking shorthand and transcription register for a double period. The same is true for students registering for dictation and advanced shorthand. It is desirable for the shorthand activities to occur within the same room as the transcription. However, in schools having more than one section of each, it may be more economical to provide separate rooms for shorthand and transcription with connecting doors. The same is true for dictation and transcription for advanced students.

The shorthand room should have chalk board, half-ruled, across the front of the room. Individual tables and chairs are desirable. The room should also contain a teacher's desk and chair, and four-drawer filing cabinets. The casework should be planned for storage of books, supplies, and instructional materials.

The bookkeeping room should have chalk board across the front of the room. A double, sliding center section is useful. Some of the chalk board may be ruled for ledger sheets. Ample cork board should be included. The working surface furniture for students should not be less than 24 by 34 inches for each student. Student chairs should be equivalent to high grade commercial office equipment.

The casework may be designed to provide individual drawers for students' materials. In addition to the teacher's desk and chair, there should be adequate filing facilities, and the casework should be designed for the convenient storage of books, supplies, and instructional materials. A room approximately 30 by 30 feet should accommodate a class of normal size.

The office practice room should be equipped much the same as a commercial business office. The following equipment may be included:

A teacher's desk and chair
Receptionist's desk
Elite and pica type typewriters--one 16 inch typewriter
Electric typewriters
Calculating machines
Bookkeeping machines
Listing machines
Duplicating machines
Protectographs
Dictating machines
Transcribing machines
Mimeoscope
Addressograph
Checkwriters
Stapling machines
Stamp affixing, weighing, and sealing machines
Paper cutting divices
Telephone switchboard
Credit retailing books
Directories, railway and postal information guides
Trade and industrial maps and charts
Correspondence files
Display cases

In this room a limited amount of chalk board is needed, but there should be as much tackboard as possible. Special attention should be paid to the electrical design and the provision of circuits and outlets suited to the many machines to be installed. Obviously a room of good size is necessary.

The provision of a machine calculation room may be feasible in large high schools in urban locations. A regular size classroom of about 900 square feet is large enough to meet the space needs. A limited amount of chalk board will suffice, but there should be a generous amount of tackboard. Special attention should be given to the provision of electrical outlets. In addition to student furniture and teacher's desk and chair, there should be a demonstration stand, filing cabinet, dill-o-type, interval timer, and case work for the storage of books, supplies, and instructional meterials.

Retail selling and merchandising may be offered in larger high schools located in urban and suburban areas. The program is intended primarily to give students competency in retail selling. High school seniors enrolled attend school one-half day and work in retail stores the other half day. The course in selling and merchandising is a two-period (two-hour) daily program. Fashion and merchandising may be given to juniors on a one-period basis. The room should contain a model retail store unit. A display window into the corridor is desirable. A laboratory section should contain a sink and a large working surface; also, electrical outlets for the use of pressing irons and hot plates. If natural gas is in the building, it is well to provide a gas burner as well.

The main room should be equipped with tables and chairs for students, teacher's desk and chair, and filing cabinet. There should be chalk board along one wall and as much tack board as possible. A cash register, change desk and wrapping facilities, a demonstration stand, and at least one male and one female mannequin should be provided.

D. Art Facilities. The art rooms of junior and senior high schools should be planned for many types of manipulative activities. The rooms should be large enough to provide ample space for students in the largest class to be accommodated to do projects of various sizes, and to move about freely in using the equipment and materials.

It is desirable to locate the art room convenient to other spaces in the building served by art--auditorium stage, crafts room, homemaking, distributive education, etc. It is generally held that a north orientation is preferred.

Special attention should be given to the design for lighting. Natural light should be supplemented by artificial light to provide a relatively high level of well-distributed illumination--80 to 100 foot candles. Brightness differences should be controlled to tolerable ratios (see Chapter IV). Electrical outlets should be suitably located.

Colors and textures of room finish and decor should provide an aesthetically pleasing environment and at the same time give a good background for the display of students' art work. The main colors should be chosen according to the room's location, and tinted for light values. There should be a minimum of contrast of light and dark and textures should be subdued but interesting.

Floors and working surfaces should be easily cared for--should be moisture and stain resistant. Working surfaces should be smooth and level, except those which naturally should be slanted, such as easels and show card tables. Working surfaces should be without specular glare and of a color which does not affect the students' art work.

Individual student furniture should provide working surfaces which will accommodate paper up to 22 by 28 inches. This furniture should be readily movable to provide for either individual or group activities. There should be a variation in heights of tables and chairs to accommodate individual growth differences.

Storage facilities are of critical importance in the art room. The following points are suggested for consideration in preparing the educational specifications:

1. Shelves and cabinets should be designed to hold all standard sizes of art materials and tools.
2. There should be storage for all students' work, both flat and three dimensional, and for both finished and unfinished articles.
3. Students' work, supplies, and tools should be readily obtainable withoutundue waste of time.
4. Storage spaces should be provided with locks.
5. There should be a metal-lined damp closet.
6. Sink equipped with sand trap and hot and cold water should be provided.

Room display facilities should be adequate and functional, and should include extensive tackboard in neutral color, provisions for hanging heavy pictures, and lighted display cases with locks. Corridor display should be made possible by a substantial amount of neutral tackboard, glass-fronted, lighted, and lockable display cases sized for three-dimensional articles, facilities for hanging pictures, and architectural stands for sculpture and flowers.

The art room should be provided with bookcases, shelves for art objects, clay and plaster bins, and filing cabinets for plans

and small materials as well as filing cabinets for charts and large prints.

The art room should have certain auxiliary rooms, including a fire resistant kiln room with forced ventilation, shelves, and storage; a photographic dark room; a spray room; and an art library - all easily accessible to the main art room.

E. Music Facilities. Among the special instructional spaces of the secondary school, none needs more careful thought in the preparation of the educational specifications than do the facilities for music. Location is a critical factor. The closest affinity is with the auditorium stage. The instrumental music rehearsal room should also have exit to the outside area where marching drill is conducted. Ground floor location is preferred for greater ease in getting in and out of the building with large instruments. It is desirable to cluster and integrate the various music spaces for unified control and supervision.

Sound control is also critical, and may be achieved partially through location and in part through structural design for sound insulation. For the control of sound within the rehearsal and practice rooms careful acoustical design, including room dimensions and acoustical treatment, is essential. Competent acoustical engineering service is a good investment.

The music facilities may often be used at night. The service facilities--heating and electrical--should be zoned for independent use. The provision of electric outlets for the use of visual and auditory instructional aids, including television, is important and should not be overlooked in the educational specifications.

Because of the normally larger groups of students in music activities and the nature of the activities, special attention should be paid to the design for ventilation.

The number, size, and kinds of music spaces will, of course, be dictated by the size of the school and the general interest in music which exists in the community. In some localities there may be a demand for some use of the facilities by the community, but where this is true it should be unquestioned that priority must be given in the plans to the needs of the school program.

Desirably there should be separate main rehearsal rooms for choral and instrumental music. In small schools a single room may have to serve both needs. It is generally unsatisfactory to makeshift by requiring the use of the auditorium or auditorium stage for rehearsal. Classrooms designed for other kinds of instruction are quite unsatisfactory for music activities. Doorways into rehearsal rooms should allow the passage of a grand piano (8 feet).

In the design of the floor of the rehearsal rooms experience has shown the advantage of providing tiers having risers of about 8 inches and a depth of from 36 to 40 inches. It is usually possible to provide storage on the top tier for percussion and other large instruments which are difficult to store in the regular instrument storage area.

Standard equipment for rehearsal rooms consists of piano, radio, phonograph, bulletin board and chalk board, and director's podium. It should be possible to darken the rooms for projection of visual aids. In the instrumental room there is, of course, the required number of music stands.

Essential auxiliary spaces include storage room for uniforms, storage room for instruments, instructor's office, rooms for individual and small group practice, space for music library, facilities for storage and convenient access to musical scores.

In the instrument storage room it is generally desirable to include a sink with hot and cold running water, and a suitable working surface with storage drawers for tools and supplies used in simple repair of instruments and equipment. This room should be located convenient to the entrance to the rehearsal room and provided with entrance and exit to the rehearsal room so that students may pick up their instruments as they move through the room. Also, the instrument storage room should be located between the rehearsal room and the auditorium stage. Even with good space orgnization, the instrument storage room tends to be a bottleneck for traffic. Therefore it is well to decentralize the storage of some instruments by providing cabinets in the rehearsal room.

Practice rooms should be located and designed to allow visibility between them and the rehearsal room. The provision of adequate sound insulation is important; also the factor of ventilation should not be overlooked.

The instructor's office should be designed to permit a view of the entire rehearsal room from within. It should contain a desk, desk chair, and one or more additional chairs along with filing cabinets. It sometimes may be advantageous to include the storage facilities for sheet music in the instructor's office.

Storage facilities for uniforms are more satisfactory if placed in a separate room located between the instrumental and choral

rehearsal rooms. However, it may be acceptable to provide suitably designed, locked cabinets within the rehearsal rooms. Special consideration should be given to space needs for dressing and changing of clothes.

F. Homemaking Facilities. The homemaking facilities constitute another special-use unit in the secondary school plant calling for great care in the preparation of the educational specifications. A separate brochure in the School Plant Planning Series is devoted to homemaking education facilities, and reference should be made to it by the planning team.

G. Industrial Arts Facilities--Vocational Agriculture and Farm Mechanics Facilities. As with homemaking, so it is with Industrial Arts and Vocational Agriculture and Farm Mechanics facilities. Separate brochures in the School Plant Planning Series are available and should be used in the preparation of educational specifications.

H. Health and Physical Education Facilities. The same is true for Health and Physical Education facilities.

General-Use Facilities

A. Library Facilities. The varied services of the secondary school library tend to make it the center of the school's activities. The library should be conceived and planned as an instructional materials center.

Its space organization, interior finish, and furniture and equipment should be designed to produce a friendly, informal, democratic, and attractive climate. Design for comfortable seeing is critically important.

1. Location. In the general space organization of the school the library should be located near the center of student traffic, away from noisy areas, and preferably near to the social studies and language arts classrooms. If the library is intended to serve the community, this also should be considered in determining its location.

2. Aims and Activities. The American Library Association has identified the major aims and activities of the school library.[6]

   a. To acquire books and other materials in line with the demands of the curriculum and the needs of boys and girls and to organize these materials for effective use.

   b. To guide pupils in their choice of books and other materials of learning desired both for personal and curricular purposes.

   c. To develop in pupils skill and resourcefulness in their use of books and libraries and to encourage the habit of personal investigation.

   d. To help pupils establish a wide range of significant interests.

   e. To provide aesthetic experience and develop appreciation of the arts.

   f. To encourage lifelong education through the use of library sources.

   g. To encourage social attitudes and provide experience in social and democratic living.

   h. To work cooperatively and constructively with instructional and administrative staffs of the school.

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[6]American Library Association Committee on Post-War Planning. School Libraries for Today and Tomorrow. A. L. A., 1945, pp. 8-10.

The activities of students in the library may be curricular or extracurricular, and range from simple reference to scholarly research. The library for the student may be a place to read or a place to explore. Students may use the library as individuals, in small groups, or in entire class groups. There is normally a steady turnover in the library and students tend to remain in the library not longer than one period at a time.

3. Size of Library. Spacious rooms are not only more attractive, they provide for more orderly activity. The American Library Association recommends that the reading room provide seating space and facilities on the basis of 25 to 30 square feet per student for from 15 to 20 per cent of the school's enrollment. If the library is intended for community use, the area should be increased accordingly. The reading room should not be planned to seat more students than can properly be supervised. It is better to provide more than one reading room in large schools--schools of 1,000 or more students. Flexibility should be a guiding factor in the design of space and selection of furniture and equipment.

4. Furniture and Equipment for the Reading Room.

   a. Shelving. Open shelving should be provided for all available wall area in the library. Modular and movable, adjustable, unit shelving provides greater flexibility. It is recommended that the shelving be sufficient for at least ten books per student enrolled.

      Seven or eight average size books may be placed on each linear foot of shelving. The depth of the shelves should be eight inches for standard sized books and twelve inches for

over-sized books and periodicals. The base should be from four to eight inches and the cornice from two to three inches.

The total height should be for junior high school libraries, from five to six feet, and for senior high schools, six to seven feet. Adjustable shelves should provide ten inches in the clear for standard size books and up to 14 inches on the lower shelves for over-sized books. Special slanted shelving should be provided for picture books and for current magazines.

b. Circulation, or Charging Desk. The size and shape of the charging desk will largely depend upon the size of the main reading room and the purposes for which the charging area will serve. The chief purposes of the desk, of course, are to take care of book charging and book skipping routines. Rectangular, L-shaped U-shaped, or unit desks are available in various finishings from standard library equipment dealers. A counter height desk usually is preferred and must be designed so as to accommodate charging trays for book circulation cards, adequate shelves for housing quick reference and reserve volumes, shelves or bins to hold returned books prior to slipping, cash drawer for fines, drawers for supplies such as pencils, date stamps, stamp pads, etc., and drawer space for record filing such as periodical check cards or for the shelf list cards. It is convenient and desirable to have charging facilities consisting of a compartment sunk into the desk top, with trays to hold book cards of books charged out, borrowers' cards, etc., and many well-designed charging desks employ book chutes for returned books. Swivel chairs of proper height should be furnished.

c. Tables and Chairs. An allowance of 30 inches of table length or more per reader is recommended and a minimum of four feet should be left in the clear between tables and between tables and shelving.

It is generally advisable to include from one to four round tables, depending on the size, proportions, and arrangement of the room to relieve angularity of appearance. The tops of library tables must be finished with a hard surface to prevent scratching, marking and soiling.

Catalog reference tables and individual study tables are desirable.

The ideal library chair is one which will provide good seating posture for a reader regardless of the reader's size or his activity, whether it be reading or writing. Armchairs are not advisable, though several easy chairs add interest and informality to a library browsing area.

d. Card Catalog Cabinets. It is assumed that each catalog tray will accommodate 1,200 catalog cards each with the necessary guides. A cabinet should be selected which would fit the needs of the library with its fully planned capacity. A minimum of ten drawers is recommended. A base should be provided for the cabinet, and sliding shelves may be incorporated into the catalog case for convenience in writing. It is recommended that card catalog cabinets be purchased from standard library equipment houses in order that the drawers will be equipped with metal rods to hold the catalog cards in permanent order.

e. Filing Cabinets. Filing cabinets should be provided for library information and pictures. Information files should be typical legal-size filing cabinets three or four drawers high. They should be of metal or wood, the same finish as the card catalog and the rest of the library furniture. Because information files usually are heavy and crowded, the drawers should operate on ball-bearing extension slides. Picture files should also be legal-size filing cabinets of the same description. There should be at least one for each purpose in a school library.

f. Book Trucks. A small school library should have one book truck, larger libraries, two. It is important that the book trucks shall be substantial, durable, and easily and silently movable.

Dictionary stands should be placed throughout the library for the convenience of the pupils. Such a stand should have sloping top with a lip along the edge and with one or two shelves underneath. If wall space is at a premium, revolving dictionary stands may be placed on reading tables.

g. Display Areas. Two bulletin boards or tackboards are desirable. They may be portable, they may be installed on wall areas, or they may be inserted as recessed areas at the back of two sections of shelving.

h. Exhibit Cases. Exhibit cases should be provided. These cases, in which rare books or other specimens of definite educational value are exhibited, should have glass frontage with lock, should provide adjustable shelves and proper display lighting. A glassed-in section of shelving is useful for an exhibit area, or exhibit cases may be counter height and portable.

Space for posters, charts, maps, art work, etc., should be included. A counter height wood cabinet of the same quality and finish as the library furniture is preferred housing for such materials. The cabinet should have hinged doors and should be equipped with sliding shelves arranged with a clear height of about three inches between the top surface of one shelf and the bottom of the shelf above and with raised lips to the back and either side of each shelf.

5. Auxiliary Spaces. Certain auxiliary spaces are essential to the well-planned library for a secondary school. These include: librarian's office, librarian's workroom, audiovisual storeroom, conference room.

   a. Librarian's Office. The office for the librarian should include a closet for cloaks, and should be equipped with a good desk and desk chair, one other chair, legal-size filing cabinet for invoices, bibliographies, bulletins, etc., shelving, a section of which may be locked, telephone, and waste basket. It should be a quiet place for work, but supervision of the library may be easier by providing a view of the reading room from the office through clear glass.

   b. Librarian's Workroom. In smaller schools the workroom may be combined with the office. It should be located to provide an entrance from the corridor and so that there is easy access to the reading room and office. Visibility of the reading room from the workroom should be provided. In the workroom incoming materials are handled and processed, books are mended or prepared for the bindery, and materials to be discarded are handled.

A sink with hot and cold running water should be provided with adjacent working surfaces. This room should include suitable storage facilities for library supplies such as catalog cards, book pockets and cards, paste, shellac, mending supplies, mounting board, electric stylus, and extra book ends. Shallow drawers should be provided in dimensions to store large poster paper and similar materials. Shelving is necessary for books awaiting processing. A good-sized table with moisture and stain resistant surface is desirable. Electric outlets should not be overlooked. A typewriter, stand, and a step stool should be included in the equipment of the workroom.

c. Audiovisual Materials and Equipment Storage. The storage and distribution for use of many varied items of audiovisual instructional aids constitutes an important part of the service of the school library. Desirably the space for this service should be located adjacent and with convenient access to the librarian's office-workroom area. It is not uncommon to so design the space that new films may be reviewed in it. The casework in this space should be designed to store the materials and equipment--films, film strips, slides, charts, posters, records, etc., and projection and sound equipment.

d. Conference Rooms. Conference rooms to be used by committees and small groups engaged in research activities should be provided. These rooms should be designed for sound control, and their interiors should be visible from the reading room. In larger schools, especially, one or more of these rooms may advantageously be equipped to use a projector for reviewing

slides and film strips; also equipped with ear phones for listening to records. Special attention should be given to the design for ventilation and lighting. The number of conference rooms to be provided should be related to the size of the school.

B. Auditorium Facilities. There seems to be a trend toward increased participation by amateurs in theatrical productions. There is a growing popular acceptance of the value of the activities of the auditorium stage. Hence, in planning the auditorium facilities for the secondary school, the point of major emphasis has tended to shift from the audience seating area to the area of the stage. This is not to deny the values for education and for sheer recreation of listening and viewing stage activities as a member of an audience, but only to emphasize that the greatest learning is to be had through direct participation in the stage activities--through performance and through stage craft.

The auditorium activities require facilities for the following identified functions:

1. Audience
2. Stage performance and productions
3. Stage craft (the creation, handling, and use of properties)
4. Dressing and make-up
5. Costume design and execution (normally carried out in the homemaking areas)
6. Art work (normally carried out in the art department)
7. Stage lighting
8. Sound control and communication
9. Projection activities

The combination of auditorium activities into a single space with some other activity, such as gymnasium or school food service, may be economically necessary in smaller school plants; but it should be clearly recognized that under such conditions the auditorium activities will suffer some degree of loss in effectiveness. For example, vision of the stage is definitely limited by any part of the audience back of the tenth or twelfth row of seats in an auditorium having a level floor. It is generally true also that stages and auxiliary spaces and facilities tend to be unduly limited in combination auditoriums. It is hard to create the atmosphere of an auditorium in a combined space. The conditioning of behavior normal to a gymnasium complicates the control of behavior suitable to an auditorium.

How large should the school be to justify the provision of a separate auditorium? Unfortunately there seem to be no universally acceptable data to supply the answer. It is suggested that if the school population is 350 or more, it may be wise to include a separate auditorium. In the borderline range of school size, there may be some advantage when there is a community interest in providing a facility which may serve community as well as school needs.

1. Audience Area. How large should the auditorium be? Policy and practice with respect to seating capacity vary, but in general the capacity is designed to seat an entire student body plus some given number to accommodate the public. However, in quite large schools, particularly, the policy is not uncommon to plan the seating capacity equal to slightly more than half the number enrolled. It is held by some that in any event, the

maximum seating capacity of an auditorium should not be more than 1,500. The suggested space allocation should probably be on the unit basis of seven and one-half to eight feet per seat if seats are in straight and an additional foot if seats are in curved rows.

Because many of the stage activities are carried on for groups no larger than one class, a special facility sometimes referred to as a "little theater," is included in the plans in addition to the regular auditorium. The stage facilities needed for such a space are minimal.

The most critical factors in the design of the audience area have to do with insuring good vision of the stage and providing for easy hearing of sounds from the stage. The shape of the area relates to both, and, of course, acoustical design is critical for sound control. There should be an insistance upon use of competent acoustical engineering service in the design of the auditorium. The relationship between stage height, the slope of the floor, and the number of seats to be installed should be given careful study with respect to sight lines. The auditorium should be without windows. The design for ventilation is critical.

Comfort, silence of operation, durability--all are probably more important criteria than is first cost in the selection of auditorium seats. Auditorium seats should be well-padded and upholstered, and should be securely anchored to the floor. Not only the seats should be silent in operation, the floor in aisles and passageways should be so finished that noise of traffic is

at a minimum. In the auditorium, as much as in any area of the school plant, good facilities invite respect and good treatment by the students.

2. The Stage. Perhaps the most serious fault in the planning of auditorium stages has been the failure to provide enough space. The width of the proscenium arch should be at least 30 feet. The depth of the stage should be at least 25 feet and preferably 30 feet. The wings equally divided on either side of the proscenium should provide a total area approximately 50 per cent larger than the stage. Platform risers the length of the proscenium arch between the audience area and the stage serve the dual purpose of steps to the stage and a means for grouping large numbers of performers within the vision of the audience.

Orchestra pits are now rarely included in the plans for school auditoriums. The first row of audience seats may be placed far enough in front of the stage to provide for orchestral groups. Likewise, it no longer is considered good practice to separate the audience unduly from the stage by placing a wide platform apron in front of the curtain.

The stage floor back of the apron should be of soft wood. The ceiling height of the stage should be high enough above the proscenium to allow for the facilities for hanging and convenient alteration of the curtain system. Entrances to the stage from corridors should allow for the rapid movement of large numbers of performers without traversing the audience area. It is desirable for fire safety to provide an automatic sprinkling

system over the entire stage area, and to separate the stage area from the remainder of the building by fire doors and fire-resistant walls.

A piano is normally a part of the stage equipment. A protective storage space at stage level should be provided for it when it is not in use.

3. The Stage Workshop. While there is an affinity between the stage and the industrial arts areas of the school, it is desirable to provide a stage workshop adjacent to the stage. This workshop might be as long as the stage is wide and separated from the rear of the stage by folding doors. Such a location might on special occasion allow the enlargement of the stage for especially large groups. It is well also to locate the workshop with double-door access to a service drive. The workshop should have a ceiling height the same as the stage. Cabinet storage equipment should be provided for stage materials such as fabrics, paste, paint, and tools used in scenery production. Racks should be included for lumber used in scenery construction, and to hold scenery frames while they are being worked on.

4. Dressing Rooms and Make-up Rooms. The provision of several dressing rooms just large enough to accommodate three or four persons is preferable to providing two larger rooms, one for each sex. The dressing rooms are more effective if located on the same level as the stage but opening not onto the stage. Toilet facilities should be conveniently adjacent to the dressing rooms. A shower for each sex is desirable. If there is no on-stage costume storage room, facilities for storing costumes

may be located in the dressing rooms. Full-length mirrors should be included in the dressing rooms.

5. Stage Lighting and Electrical Design. The trend in the lighting of auditorium stages is away from the use of foot lights and toward the use of spot lights located on the walls and ceilings of the auditorium and proscenium. The design of stage lighting is a technical task. Careful study should be made in the specifications of materials, equipment, and control panels. Careful planning should also apply to the design for a public address system. Numerous convenience outlets should be provided and located to prevent the need for long cords.

6. Projection Activities. The facilities for the use of projection equipment should not be overlooked--a booth to house projector for large audiences, large audience screen, and storage space for stands, projectors, and screens used for small audiences.

Connecting Spaces

Corridors, foyers, and courts can be much more than mere connecting spaces in the general organization of space in the secondary school. Properly designed such spaces can yield good educational values. To be sure, the primary function of foyers and corridors is to facilitate the movement of persons into and out of the building and from one area to another within the school plant. The cost of such spaces adds materially to the total cost of the school, and good space organization requires holding their area to a reasonable minimum, not only in aggregate area, but in length of any continuous corridor. The designed width of a corridor should be calculated not only to allow the free movement of normal peak loads in

ordinary traffic, but to permit the rapid evacuation of the building in case of panic. Connecting spaces should be well lighted.

But beyond the traffic purpose of connecting spaces, it is a good investment to provide for the substantial educational values inherent in such spaces. Above all, connecting spaces may be made attractive and relaxing so that students in moving from one class to another may arrive at their destination in a favorable frame of mind. The amount of space, the kinds of finish, the hanging of pictures, providing a view into landscaped open areas, the provision of display facilities, and even the provision of lounging nooks--all are examples of the means through which connecting spaces may also be made "productive" spaces.

Student Commons

The concept of "living while learning" and the related modern emphasis upon social-emotional development of students as individuals call for some consideration of facilities which are primarily directed toward facilitating the achievement of these values.

There is at least the beginning of a trend toward including such facilities in new secondary schools. They are frequently referred to as "Student Commons." Within these facilities students engage in unstructured, informal relationships in pairs and small groups throughout the school day as circumstances permit. Also, the facilities accommodate certain planned activities, quite often in hours outside of the regular school day, such as class parties.

A location adjacent to an open court and close to the library is desirable. Supervision and control of activities are made easier, too, if

the other student activity spaces discussed on page 58 are near the student commons.

The student commons should be informally, comfortably, and attractively furnished. A snack bar is usually included in the area. Toilet facilities should be conveniently near. In larger schools the area is sometimes designed to include movable partitions with satisfactory sound drop so that two or more small groups may utilize the space at the same time.

Selected References and Sources

An important part of the equipment of the school plant planning team is a carefully selected collection of reference materials. The titles listed below are suggested as examples of such materials. References are not included here which deal specifically with the facilities for which separate brochures are available in the School Plant Planning Series (separately listed below). Such references are cited in the respective brochures.

Periodical Sources of School Plant Articles

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17. New England School Development Council. The Road to Better Schools. New England School Development Council, Spaulding House, 20 Oxford Street, Cambridge 38, Massachusetts, December, 1955.

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19. New York Commission on School Buildings. Doorway to Better Schools. State of New York, Commission on School Buildings, Albany, New York, June, 1953.

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School Plant Planning Series

(Publications of the Utah State Board of Education, 223 State Capitol)

1. Planning the Elementary School Plant.

2. Planning Health and Physical Education Facilities.

3. Planning Homemaking Facilities.

4. Planning Industrial Arts Facilities.

5. Planning the Secondary School Plant.

6. Planning School Food Service Facilities.

7. Planning Vocational Agriculture and Farm Mechanics Facilities.

8. Planning a Program of School Plant Construction.

9. Planning a School Plant--The Educational Specifications.